958.b.10.
2
1739

TEN PRACTICAL

DISCOURSES

Concerning the

Four Elements,

As they Relate to the

Growth of PLANTS.

VIZ.

I. Of the Improvement of Land in general.
II. Of the Principles of Water, and the Neceſſity of it in Vegetation.
III. Various Methods relating to the Draining of Lands.
IV. Of the ſeveral Parts of Plants, and their reſpective Offices, *&c.*
V. Of the Anatomy and Motion of Juices in Plants.
VI. Of the different Ways of propagating Plants.
VII. How to make Plantations, either for *Pleaſure* or *Profit*.
VIII. Rules for Pruning, *&c.*
IX. Of a *Kitchen Garden*, and the Particular Management of *Vines* and *Figs*.
X. Of a *Flower Garden*: With ſome new Obſervations relating to Flowers and Exotick Plants.

WITH
A Collection of new Diſcoveries for the Improvement of Land, either in the *Farm* or *Garden*.

By the late Ingenious
R. BRADLEY, Profeſſor of Botany in the Univerſity of *Cambridge*, and F. R. S.

The SECOND EDITION.

LONDON:
Printed for R. WARE, at the *Bible* and *Sun* in *Warwick-Lane*, *Amen-Corner*; B. CREAKE, at the *Red Bible* in *Ave-Mary-Lane*; and J. OSBORN, at the *Golden-Ball* in *Pater-Noſter-Row*. 1733.

K
26

BRITISH
MUSEUM

THE PREFACE.

Concerning the Growth and Management of Plants, *and the Improvement of Land, we have already many Pieces which have been made publick; but ſtill I find that the Buſineſs of Gardening admits of more Reaſoning than has yet been publiſh'd.* Botany *is a vaſt Field, which affords every Day new Matter for Contemplation; and the more curious we are in that Study, the more Variety we find* *in it:* The Knowledge of Plants *is, and always has been thought worthy the Regard of the greateſt Philoſophers, and when that Knowledge began to be well enough underſtood to improve Land and Eſtates by it, what Eſteem, and what Honours did the firſt Improvers gain by their Skill.*

The Names alone of thoſe Men who are famous in Hiſtory on Account of their Excellency in this Study, would fill a Volume; we may trace them to the firſt of Times, when Knowledge was confin'd to a ſmall Part of the World; and we are oblig'd to the Greeks *and* Romans, *for diſtributing to us their learned Remarks and Obſervations upon it, and from whence indeed is derived the Taſte,* *which now moſt of our Gentry fall into of* Agriculture *and* Horticulture, *Studies ſo profitable and uſeful as theſe are, ſurely cannot employ too much of our Time, ſince Wealth and Health are the Conſequences: 'Tis therefore I have deſign'd the following Sheets to inſtruct ſuch as bend their Mind towards theſe profitable Diverſions in the Principles of them, and have taken care that nothing ſhould be wanting to render thoſe Arts eaſy and familiar to the meaneſt Capacity.*

THE

THE CONTENTS

Discourse I.

OF *the Improvement of Land in general.* p. 1

Discourse II.

Of the Principles of Water, *and the Neceſſity of it in Vegetation.* 17

Discourse III.

Various Methods relating to the draining of Lands. 41

Discourse IV.

Of the ſeveral Parts of Plants, *and their reſpective Offices with regard to Vegetation.* 53

Discourse V.

Of the Anatomy and Motion of Juices in Plants. 69

Discourse VI.

Of the different Ways of propagating of Plants by Seeds, Cuttings, &c. 95

Discourse VII.

The manner of making Plantations, either for Pleaſure or Profit. 119

Dis-

Discousre VIII.

Rules for Priming of Wall-Trees, Dwarfs, and ſuch others as are ſubject to the Knife. 132

Discourse IX.

Of the Diſpoſition of a Kitchen-Garden, and the particular Management of Vines and Figs. 148

Discourse X.

Concerning the Diſpoſition of a Flower-Garden, with ſome new Obſervations relating to the Improvement of Flowers and Exotic Plants. 166

DISCOURSE I.

Of the IMPROVEMENT of LAND in General.

ALtho' the Arts of Husbandry and Gardening have been accounted in all Ages worthy the Study of the greateſt Philoſophers, yet we do not find any of the Writers of thoſe Subjects have given themſelves the Trouble of laying before us the Principles or Rudiments upon which thoſe great and beneficial Works are founded, for want of which, I conceive the falſe Reaſonings and Acting in theſe Particulars has proceeded, and the many Miſcarriages which we daily obſerve are owing.

In Order therefore to act with ſome Certainty in our Undertakings of this Nature, it will be neceſſary to conſider the Uſe of Earth in general, with Regard to Vegetation; and ſet forth the ſeveral Sorts of Earths, which are moſt common with us in *England*: From whence it will follow, That I treat of the Enriching or Improving one Soil by another, or by ſuch Compoſts or Manures, as are uſed by the moſt expert Husbandmen or Gardeners.

The Uſe of Water likewiſe, as far as it relates to Vegetation, will not be unworthy our Regard: To which I ſhall add ſome practical Obſervations concerning the raiſing and forcing of Water to ſuch Places or Eminences where it is wanting.

I ſhall in the next Place, treat of ſuch Lands as are drown'd, or lye continually under Water: To which I ſhall add an Account of the moſt approv'd Methods for draining off the Waters, and bringing ſuch Land into a fruitful State.

I ſhall then proceed to explain the Uſes of the ſeveral Parts of Plants, and lay down ſome Proofs of the Sap's Circulation, and alſo explain the Manner how Plants generate: From whence it will naturally follow, that I mention the various Methods of Encreaſing Plants by Seeds, Layers, and Cuttings, and then ſhall preſcribe the Manner of making Plantations either for Pleaſure or Profit.

To which I ſhall add the Advantages of Pruning Wall-Trees, Dwarfs, Eſpaliers, *&c.* from which I ſhall proceed to treat of the Diſpoſitions of a Kitchen-Garden, and lay down proper Rules for the Culture and Improvement of Flowers, and ſhall conclude with proper Directions for the Culture of Exotic Trees and Flowers, with ſome Conſiderations concerning the building of Green-houſes, Stoves and other Conſervations, in which Work will be contain'd all the Principles upon which both the Arts of Husbandry and Gardening are founded.

According to theſe Propoſitions, I am firſt to enter upon the Subject of Soyles, that we may know the Uſe of Earth in Vegetation, as the Foundation of all our Work; for unleſs we can judge rightly of this, we cannot have any Certainty of what we undertake, either in the Field or Garden.

In this Caſe it will be neceſſary to enquire into the Particulars; firſt to examine into the Nature of the Soil, whether it be heavy or light, cloſe or open; and ſecondly, to know the Depth of it.

As to the firſt Point which we are to enquire into, *viz.* the Nature of the Soyle, whether it be heavy or light, cloſe or open: I mean whether it be heavy or cloſe as Clay, or light and open as Sand; for upon one or other of theſe depend the Sorts of Soyl that have hitherto been obſerved.

Sand is the Principle of every Soyl, which ſeems to vary only as the Sand is more or leſs mix'd with the Parts of decay'd Vegetables or Animals, from whence it is render'd fruitful in ſeveral Proportions, and has its Parts more cloſely united, as the Parts which are mix'd with it, abound in viſcous or oily Juices.

Again we may obſerve, That Sand is of two Sorts; either conſiſting of round Parts or angular Parts: We may alſo take Notice, that Sand is of various Colours, as grey, white, yellow, orange or red, blue, and black, and if any of theſe Sands, ſuppoſing them to conſiſt of round Parts, happen to be mix'd with a due Proportion of the Parts of Vegetables and Animals, they produce a fertile Soyl, which is more or leſs pinguid as the viſcous or the oily Matter abounds in them, thus have we Earths of all theſe Colours, and of various Degrees of Fertility, Strength and Stiffneſs; thoſe which have their Parts the moſt cloſely united by this means we call Clay, and thoſe Earths which are leſs binding, and are in the Middle Degree between Sand and Clay, we call Loam; and from theſe we may reaſon upon all the reſt.

As a Demonſtration of what I lay down, if we take Clay of different Kinds, and lay every Sort in ſo many different Panns of Water, till they diſſolve, either of themſelves or by Force, we ſhall find, either a viſcous or oily Matter ſwimming upon the Surface of the Water; and upon examining the Earthy Parts, we ſhall find its Principle Sand connex'd with ſuch duſty Parts as I have mention'd, as will appear by the Microſcope; which will plainly diſcover them to be broken Parts, either of Vegetables or of ſuch Things as have had proper Veſſels for their Juices to move in, ſuch as cannot be found in Sand or any kind of Stone.

It is obſervable in Clay-Lands which lye upon a Deſcent, that by great Rains ſome of the Parts of the Clay lying next the Surface, are frequently carried by Drifts into Hollows, which by a violent daſhing of the Waters, looſe the viſcous or the oily Matter which bound the Parts together; ſo that when this is dry'd it will become like Duſt, open in its Parts, but without ſuch waſhing would become hard by drying, as all Clays or Bodies, conſiſting of fine parts, of Vegetables or Animals mix'd with oily or viſcous Matters will do by Inſolation. This we may obſerve in Meal and Water when they are mix'd together in Paſte, where the Parts of the Vegetable being viſcous, they bind cloſely when the Water is put to them, and become of an extraordinary Hardneſs, when the Maſs is thoroughly dry, and if we mix Flower or Whiting with Oyl, and let ſuch Mixtures remain till they are dry, they become hard as Stone.

Again, if we put Oyl or any viſcous Matter to Sand, which has been waſh'd clean from the Vegetab[illegible]r Animal Parts, we ſhall find that this Maſs, when it is dry, may be freely broken; but if we mix ſuch Mould with it as proceeds only from rotted Leaves, it will become of a very binding Nature, even as tough as any of that Soyl which we call natural Clay.

The Soyl which we eſteem the moſt, is that which we call Loam, becauſe its Parts are not too much reſtrain'd or bound together like Clay; nor are ſo open and forcible as Sand, this Soyl is pleaſant to the Husbandman, for that it does not want ſo much Force to turn it up as is required in the ploughing of Clay-Land; and in the next Place, in once ploughing, the Loam I ſpeak of will break and fall fine, when a ſtrong Clay muſt be plough'd three or four times before it will be mellow and even, then the viſcous Juices abounding in it will occaſion it to bind as hard as it did before, unleſs we overpower thoſe Juices, by mixing a good Quantity of ſuch Sand as is ſharp and conſiſts of angular Parts, which one may find on the ſides of Rivers, and on the Sea ſhoar, or in Ditches, by the ſides of great Roads that are gravelly, If we undertake to reduce Clay to this middle-ſtated Soyl, which I call Loam, it is the cheapeſt Way to do it at once; for conſidering how laborious it is to plough a ſtubborn Clay, as it ſhould be, and how much more at Liberty ſuch Land will be to diſpence its Riches, when its Parts are open'd by a due Quantity of ſharp Sand, we ſhall preſently find our Account.

The beſt Rule I can lay down for this Manuring of Clay with Sand, is to let the Sand be ſpread upon the Ground two Inches thick, provided we do not plough all together above ſix Inches deep, which will be enough for any Annual Crop; but this ſhould have two Ploughings before we ſow upon it, in order to mix the Sand and the Clay together.

Or, *Secondly*, we may reduce our Clay-Ground to the Temper of the Loam I mention, by ſpreading ſuch black ſandy Soil upon it as is commonly found in Heath-Ground, wherein are many woody Parts of the Heath and ſtringey Roots, which will very much help to open the Parts of the Clay, and being mix'd with it, will become a fruitful Soil.

Thirdly, we may reduce our ſtubborn Clay by Sea-Coal Aſhes, ſuch as we may make out of waſte of Coal-Pitts, lay'd in little Heaps upon the Ground, and burnt with Furze.

Fourthly, our Clays may be open'd and fertiliz'd by Lime, eſpecially ſuch as is call'd Stone-Lime; this is frequently practiſ'd.

Fifthly, by Lime and Dung mix'd, when it has been lay'd ſome time together, S. S. we may uſe with this rotted Wood, and rotted Leaves, which will ſtill help our Deſign; for Wood, Leaves and Roots have ſeldom any viſcous Matter in them.

Sixthly, the burning of ſtiff Clay is a great Help to cold Clay Grounds; by burning it in little Heaps and ſpreading the burnt Parts upon the unburnt Ground; for this becomes, by burning, ſharp as drift Sand, and ſo keeps the Parts of Clay open, ſo as to ſuffer the Richneſs of the Clay to help in Vegitation; whereas, when the Land is overbound or ſtiff, the Vegetable Quality is ſo much confin'd, that the tender-rooted Plants, which happen to be ſtation'd in it, cannot receive ſufficient Nouriſhment from it, otherwiſe it is certain, there is no richer Ground in the World than Clay, if its Parts can be laid open enough for them to diſtribute their Riches; for we ſee plainly, that if we, by tranſplanting a young Timber Tree upon ſuch a Soil, can but preſerve it a few Years, till it can gain Strength in its Roots to penetrate ſuch ſtiff Soil, and make its Way to its Nouriſhment, it will flouriſh extremely, the Oak eſpecially; but if ſmall tender Plants which are not of a robuſt Nature, be ſet upon ſuch ſtiff Land, we may expect a very poor Account of them.

Virgil, when he ſpeaks of the Richneſs of Soil to be choſen by the Husbandman, obſerves, with a great deal of Juſtneſs, that a pinguid Soil is the moſt profitable; but by no means can I agree with him in deſpiſing a light Soil, and making it barren: Indeed as the Caſe was with him, in a Climate which had as much Share of Heat in the Summer, ſuch as about *Naples*, as any Part of *Europe*, ſo no light Land could be very profitable there, becauſe ſuch Earth has not Tenacity enough to hold Moiſture, ſufficient for the Nouriſhment of Plants, and in that Senſe may be ſaid to be unprofitable; but in ſuch a Climate as ours, which is not expos'd to ſuch violent Heats, we find the light Soil preferable, upon many Accounts; but it muſt be obſerv'd, that when I ſpeak of light Soil, I do not mean ſimple Sand, but ſuch as partakes of Vegetable or Animal Parts, as I have mention'd above: But then they muſt not be too much impregnated with viſcous or oily Parts, for when we come to conſider the ſeveral Degrees of Growth and Strength of Plants, we find that ſome Plants grow beſt in a very light Soil, others delight in Soil ſomewhat heavier and cloſer in its Parts, and the more robuſt Plants rejoice in the more pinguid Soils; ſo that we muſt be always careful to give every reſpective Plant its proper Soil, that is, when we have Soils of different Sorts, we muſt contrive to cultivate ſuch Plants upon every one as are moſt natural to each Soil.

But as it is impoſſible to find every Variety of Soil upon one Eſtate, ſo it will be beſt to bring our Grounds into ſuch a Poſture, as to imitate the middle-ſtated Soil, which I call Loam, for both the tendereſt and the moſt robuſt Plants will proſper in a Soil of that kind.

So if we have ſandy Ground, which we account too light, we muſt give it Strength by a Manure of

Clay or ſome rich Marl, or by ſowing it with ſuch Plants as are of a viſcous Nature, and making a Manure of them, for the ſame Ground they grow upon. *Columella* gives us a Chapter upon this Subject, where he recommends the Lupine for a great Improver of light Land, as it abounds in viſcous Juices, he directs us to cut the Stalk of the Lupines in Pieces, and plough them in about 2 or 3 Inches deep, and I have found that a Crop of Turnips ſown pretty thick to be fed with Sheep, or only to be mow'd down, and after a Week or ten Days to be plough'd in, will be of extraordinary ſervice to ſuch Land.

Or if ſuch ſandy Land happens to lye near the Sea, it is a common Cuſtom to manure it with Fiſh, and Sea-Weed of any Sort, which brings the Farmer extradrdinary Profit.

It is practic'd about *Dunſtable*, to manure their Clay Grounds with Woolen Raggs chopt ſmall; and in other Places, to lay the Hair of Animals upon ſuch Ground, both which proves advantageous to the Farmer.

It is neceſſary however, to make a general Compoſt of every waſte Thing about a Farm, *viz.* the Dung of Poultry, the Dung of Sheep, the Dung of Horſes and of Kine, Aſhes, rotted Wood, Leaves, Litter, Straw, Grains if they happen to be ſpoil'd, and ſuch like, to be lay'd together in a Pitt, and mix'd with Earth, and it may be ſo contriv'd, that the Drain of the whole Yard may run into it: We may alſo add Fern and Weeds if we have not ſuffer'd them to Flower; all this when it is well mix'd will make an excellent Compoſt for any Ground.

About the Iſle of *Eſly* the Farmers uſe Abundance of Pidgeons Dung, which they ſow upon the Ground; it is full of Salt, and is of a very hot Nature, but their Land is cold and ſtiff; ſo that it is mended by this Manure.

But if it ſhould happen, that we have a Tract of ſimple Sand, which is accounted unprofitable, let us not deſpair, ſince it may be cultivated for Liquorice, Carrots, Parſnips, Turnips, and Potatoes; and ſuch Ground, will, without any Manure, bring theſe Crops to great perfection; or if we deſire a more durable Crop upon it, the Firr-

Tree may be ſown or planted there, with great Advantage.

We are alſo to obſerve, that Gravel and Sand are nearly the ſame in Nature, and what will grow in one will commonly grow in the other. Theſe are both ſubject to Springs, and when they happen to be ſo, they are then only proper for ſuch Plants as are natural Inhabitants of the Waters, ſuch as Alders, Willows, Oſiers, *&c.* but when they lye dry, they may be improv'd both by the ſame Means.

But I come now to conſider the Depth of the Soil, and how far it is neceſſary to obſerve that, before we begin to ſet it in Action.

When we find our upper *Stratum* of Earth, but two Inches deep of a ſtiff Earth, and the Stratum below it Gravel, we may then, by Plowing, make a Coat of tolerable Soil four Inches deep, to which if we add ſome of ſuch Compoſt as I have directed, it will bring Corn, and after that Turnips and Peas and Beans, or any Thing which takes a ſhallow Root in the Ground.

2d. If we find a tolerable Mould, about three Inches upon a Clay, we may work thoſe together about ſix or ſeven Inches deep, if we have the Benefit of the Ingredients which I have mention'd as Manures for Clay Ground; and this will bring good Corn or Pulſe; but generally where the Surface is very ſhallow, that Ground is beſt for Graſs, Clover, St. Foyer, and ſuch holding Crops.

If our Bottom be Clay of a great depth, and we have a ſhallow Surface, it may ſerve to make a Seminary of young Oaks, or any Timber Trees, with Taproots, or to be ſown with Aſh, Keys, Hazle, &c. for Coppice Wood; but where the Clay is ſo near the Top, it is hazardous to plant Trees in it of any conſiderable Magnitude, eſpecially the common way which is practic'd by moſt Gardeners when they make Plantations in Clay Grounds, the ſuperficial *Stratum* of Earth or Mould perhaps not being more than three Inches deep, they look'd upon it to be of ſo little Value, that 'tis generally loſt or thrown away, and the ſecond *Stratum* of Clay not being thought good neither, the Places where the Borders are to be, or the Trees are to ſtand are Trench'd, and the

Clay taken out two or three Foot deep, which Trenches are to be repleniſh'd with fine Mould, brought thither at great Expence, the Conſequence is, that upon the firſt great Fall of Rain, the fine Mould lodg'd in theſe Clay Trenches, becomes Mud, and chills the Roots of the Trees, there being no Way for the Water to run off, which brings the Canker firſt, and then Death to the Trees; but to avoid this Inconvenience, and ſave Expence, let the ſuperficial *Stratum* of Mould be par'd off the Clay, eſpecially where the Walks are to be, and let that Molud be lay'd upon the Borders, to raiſe them to a convenient Height, without digging at all into the Clay, the Walks or Spaces between the Trees may be fill'd up to them with Rubbiſh, or any ordinary Soil; with this Management Trees will proſper, their Roots are at Liberty to ſeek Nouriſhment where they can beſt find it.

DISCOURSE II.

Of the PRINCIPLES of WATER, and the Neceſſity of it in Vegetation.

THE Diſcourſe I am now upon has no need of a Preamble, to ſet forth the ſeveral Opinions concerning Water as an Element, or is it neceſſary I obſerve any more of it Philoſophically, than barely taking Notice, That it is generally allow'd to conſiſt of Globular Parts; from whence proceeds its Fluedity, as appears by its Currency, when it is put upon any ſmooth Surface which has the leaſt Declenſion:

And Sphærical Parts, of which all Water is compoſ'd, are capable of being render'd more light or volatile, or of being more rarify'd by a greater Share of Heat, ſo as to ſwim in the Air; or, as one may ſay, mix it ſelf with it; or of becoming more Denſe, even to be fixt as Marble by a greater Degree of Cold, ſuch as it is in Ice: This is chiefly what I ſhall have Occaſion to touch upon concerning the Principles of Water, in this Diſcourſe.

The Uſe of Water in the Education or Nouriſhment of Vegetables, ſeems from Experience, to have a much greater Share than Earth it ſelf; becauſe we find, that beſides the Advantage it is of to Plants when it is thrown near the Roots of Vegetables, which thoſe Roots imbibe with the Salts or nouriſhable Parts of the Earth, the Vapour ariſing from it aſſiſts the Plants in ſo great a Degree, as to give them a double Vigour; as may be obſerv'd by ſetting a Quantity of Plants in Pots upon a Stone Pavement, and keeping them duly water'd; theſe will ſcarce have half the Strength of Growth in a Summer, that Pots with the ſame Sorts of Plants will have, that have ſtood upon the naked Ground, where the Earth about them has had Opportunity of Diſcharging its watry Parts in Vapour; for the Leaves, Bark, Flowers and Fruit of every Plant reecives Nouriſhment from ſuch Effluvia, very near as much as the Plants do by their Nouriſhment drawn in by the Roots. But this is in General, for ſome Plants which are very ſucculent, will endure many Years in a State of Life without either Earth or Water, feeding upon the watry Parts only which ſwim in the Air; ſuch as the *Sedum-arboreſceus*, and ſeveral other Sorts of Sedums or Cotyledoms, when they lay them up in the Houſe, will even put forth Roots when the Air becomes moiſt; but theſe have very few of thoſe Sap-Veſſels which draw Nouriſhment from the Root, and therefore if we give them much Water, when there is not Heat enough to exhale it, quickly it ſtagnates about the Roots and rots them: Therefore, where this is the Caſe, never give ſuch Plants Water, but when you are ſure of Sun or Heat enough to evaporate it quickly. But Trees which have many Sap-Veſſels, which are fed by the Roots, require more conſtant Waterings, as I ſhall have Occaſion to explain in another Place. We may obſerve too, That the more ſucculent a Plant is, the fewer Roots it has in Proportion; and ſo it is a certain

Rule, That the more ſucculent Plants muſt have the leaſt Share of Water.

We are in the next Place to conſider, How Plants in General are affected by Water, and what are the viſible Signs of their want of it.

Every Plant, whether it has a bulbous, tuberous or fiberous Root, receives its Nouriſhment by means of the watery Parts in the Earth, at the Extremities of its Fibers; for all Bulbs are nouriſh'd, as well as tuberous Roots, by the Mouths of their Fibors; as will be deſcrib'd in the Account of the Structure of Plants.

For this Reaſon, it is neceſſary when there is an Occaſion for watering a Plant, that we pour the Water where we can reaſonably ſuppoſe the extreme Parts of the Fibers lie, which in large Trees may happen to be at a conſiderable Diſtance, even ſix or eight Foot from the Body or Stem of the Tree: But if we water ſuch Trees, as is the common Practice, cloſe to the Stem, the moſt of the Fibers are not benefited by ſuch Waterings, and the Tree ſtill ſuffers: Neither ſhould we alone conſider the Neceſſity of watering immediately, where we may judge the Mouths of the Fibers are ſituated, but refreſh the Ground plentifully a Foot or two beyond that Place, that the Water may not be too ſoon exhaled, but have Time to lie and nouriſh the Tree as well by the Roots, as by continuing its humid Vapour about the Stem, Leaves and Fruit, to nouriſh the more ſpungy Parts of them, while the Roots are gathering convenient Subſiſtence for their Offices.

The Signs of a Plant's Want of Water are many, but it is dangerous to wait till they appear, for our Remedy may come too late. We are acquainted with the Diſtreſs of Plants by the Shrinking of the Leaves, by their turning yellow, by their flagging or hanging down; and by the dropping of the green Fruit in Trees: So that when ever any of theſe Tokens declare their Wants, we muſt not delay to give them good Waterings, as I have before mention'd. A Day or two, if the Weather be very hot (as one may reaſonable ſuppoſe it muſt be, when this happens) is likely to occaſion the Death of the Tree; or if it be a ſmall Plant, we may be ſure of its Deſtruction by a Day's Neglect.

We

We ought in this Caſe to conſider our Soil, whether it be Sand or Clay, or light open Ground, or ſtrong ſtiff Land; if it is the former, watering of our Fruit-trees will be neceſſary more frequently than in the ſtrong holding Soil; a Fortnight or three Weeks dry Weather in Sandy Land is enough to truſt a Fruit-tree without Water, eſpecially if it happens to be in a warm Situation; but if it be a ſtiff Soil, a Month's Drought will do it no Harm, but longer than that it will hardly do well without watering: At the ſame time we ſhould ſtir the Surface of the Earth we deſign to water, which will keep it from binding too hard; which it will be apt to do, if it is tending to a Clay.

I cannot help obſerving, that it is an Error to lay the Flower-beds in Partere-works high in the Middle, or round, as the Gardeners call it; I would rather adviſe that ſuch Beds be made concave, ſo as to lie hollow in the Middle, for as theſe ſhould chiefly be furniſh'd with annual Flowers in the Summer, and the moſt fiberous rooted Plants, and perhaps Ever-green likewiſe, by this Means the Watering they may require in the ſcorching Seaſons, will be effectual to them; whereas if they were to lie in a Convex Manner, the Water would run off, and theſe Plants receive little or no Benefit from it.

When I ſpeak of the Concavity of theſe Beds, I mean only, that there ſhould be a very gentle Declenſion from the Sides to the Middle, as much only as will keep the Water from running off.

There is indeed ſome Beauty in the Roundneſs of a Bed, and that Roundneſs is neceſſary when we deſign a Bed only for our fineſt Bulbous-roots, becauſe their chiefeſt Growing-time is in the moiſter Seaſons of the Year; and therefore this Convexity is a neceſſary Proviſion to carry off the Water, and thereby preſerving our Bulbs from rotting: And as theſe have done their Office before the extreme Droughts begin, ſo this Faſhion is proper enough for ſuch Kinds of Roots.

In watering of Plants we are to obſerve, that the Evening in the hotter Seaſon is the moſt proper Time for that Operation, becauſe that the Water will then have Time enough to mix it ſelf with the Earth, before the too ſcorching Heat of the Sun can exhale it, or occaſion it to ſcald the Roots of the Plants; which will be the Caſe if we water Plants in the Heat of the Day.

I am to be underſtood thus far only of watering Trees, and ſuch Plants as are growing in the natural Ground; but the watering of Pots requires ſome further Conſideration.

The Earth in every Pot ought to be riſing a little about the Stem of the Plant, and fall gently to the Edges, that ſo the Water may rather fall to the Parts of the Pot among the fine Fibers of the Plant, than lye ſoaking about the Stem.

At every 3d or 4th watering of a Pot, the Surface of the Earth ought to be ſtirr'd; which otherwiſe would bind too hard about the Plant, and not admit the Water equally to the Roots of the Plant: Or elſe, we may lay on an Inch thick of freſh Cow Dung upon the Surface of the Pot when the Heats begin, which will prevent the Sun's ſcorching of the Roots, which otherwiſe frequently happens.

When we have Trees or Plants in Pots that require a great Share of Water, they ſhould be ſet in ſhady Places during the great Heats of the Summer; or elſe the Bottom of their Pots may be ſet two Inches in Pans of Water; from whence, through the Holes at the Bottoms of the Pots, the Plants would draw what Water they require, and ſo will remain in good Condition a Fortnight in the hotteſt Weather with ſupplying the Water-Pans: This is much the beſt Way of treating Myrtles in the Summer, as well as other vigorous ſhooting Plants, which are not ſucculent.

It is alſo of great Advantage to all Sorts of Plants in Pots, to ſet Tubs of Water, or Tubs or Caſes of Water Plants among them in the hotter Seaſons, becauſe there is continually exhaling ſuch Vapour from thoſe Bodies of Water, as the Leaves, Bark, and ſpungy Parts of the potted Plants imbibe and are aſſiſted by.

I have alſo found it beneficial to Orange-trees, and other Green-houſe Plants, to ſet Pans and Caſes of Water among them when they were in the Conſervatory; and eſpecially when the Weather is too ſevere to open the Houſe, or let in freſh Air amongſt the Plants: For theſe Caſes of Water, by their continual Exhalation, keep the Air of the Houſe from growing ſtagnant, and conſequently preſerve the Plants from growing mouldy; beſides it keeps the Bark and ſpungy Parts of the Trees fill, and prevents the Trees from that dangerous Diſtemper of being Hide-bound: Such Pans and Caſes I alſo find neceſſary to be placed in forcing Frames for forward Fruits; the Water in them nouriſhes both the Trees and the Fruit, eſpecially if the Seaſon be too briſk to allow them much Air: And I am of Opinion, when the Summer is very dry, Pans of Water would very much help our Wall-fruit-trees to be ſet near them; for the Fruit of every Plant conſiſting chiefly of ſpungy Parts, is chiefly nouriſh'd by the Moiſture in the Air, the Sap-Veſſels being very few in Number, which conveys the Nouriſhment from the Root to the Fruit.

In *Holland* they have a particular Way of watering Melons, by placing Pans of Water near the Plants, and having dipp'd a Yard of the Liſt of Woolen Cloath in Water, they lay Part of the Liſt in the Pan of Water, and the other End of it is laid over the Root of the Melons, by which Means the Melon-plants draw to themſelves the Quantity of Moiſture which is neceſſary for their Support, and in 3 or 4 Days the Pans will have loſt all their Water, tho' one of them which has not had a Liſt in it, will not be dry'd up in three Weeks, ſo that we cannot ſay the Water is exhal'd by the Sun.

But as I have directed the Time of watering in the Summer to be in the Evening, ſo on the other Hand our Potted-plants which are preſerv'd in the Conſervatories during the Winter, muſt at that Seaſon be water'd when they poſſeſs the greateſt Share of Sun, or rather about Noon than in the Evening; that the warm Air in the Houſe may prevent the Water's chilling the Roots of the Plants: For I find, that the Air in a Green-houſe, whether the Sun ſhines or not, will be warmer in the Day-time by ſeveral Degrees of the *Thermometer*, than the Air of the Night.

When I direct Tubs and Pans of Water to be ſet among Plants, there is an Advantage we may receive from it, which I have not yet taken Notice off, That this Water, when it has ſtood a

Day or two, will be equally warm with the Air of the Houſe; but to keep it from Putrifaction, put ſome Earth at the Bottom of the Tubs, and when we uſe any of it, fill up the Tubs with freſh Water, the Earth will enrich it and ſoften it, and its Situation for a Day or two will temper it ſo as to aſſiſt the Vegetation of the Plants in the ſame Climate with it.

But the Uſe of Crude-water to Plants is rejected with as good Reaſon as the ſowing Seeds upon Crude-Earth, which is ſuch Ground as has been taken from ſome hidden Part, where the Air has not had any Opportunity of Freedom with it, both the Water, and the Earth I ſpeak of, muſt have Time to mellow or mix with the free Air, before we find them qualify'd for Vegetation; ſo that Pump-water from a deep Well is not proper for Plants, till it has been expos'd ſome Time to the Air and Sun, or elſe has had a little Earth, ſuch as the lighteſt Loam, thrown into it, which will correct its Rawneſs, ſo as to ſoften it, and render it mellow enough to be uſed with Soap: So we find River-water and Pond-water much more aſſiſting in Vegetation, and more generally uſeful than our common

Pump-water; and it is the earthy Parts, as well as the Air that make them ſo, for all Rivers come from Springs which are hard and crude, if we were to uſe the Water at the Spring-Head, but their Paſſage thro' Earth and Air renders them ſoft, and capable of mixing with the oily Parts of Soap; and ſuch Water is to be coveted for Plants: For in ſuch Waters great Variety of Plants will grow, as is evident in every River and Pond, but ſeldom any Plant of more worth than Moſs, is found about a Spring-Head.

In the Education of Water-plants in Tubs, Caſes or Pots, I have try'd both River-water and Pump-water, and I found that ſuch Plants as were raiſed in Pump-water were ſmaller than thoſe that were fed by River-water, and were the apteſt to bloſſom. Our Pots, Caſes, or Tubs, muſt be made very light, ſo that none of the Water can run out, and each of them muſt be fill'd ſo full of Earth, as to leave Room enough for a Depth of Water, according to the Heighth which the ſeveral Plants may require which we ſhall plant in them: And as there will be a great Exhalation of Vapour from theſe Water-tubs in the Summer, we muſt be mindful to fill them up with freſh

Water from Time to Time, as the Water in them decreaſes.

And as I have ſet forth the Uſe of Water in the Education of Vegetables, ſo in the next Place I ſhall mention the moſt practical Methods of conveying it from one Place to another, where Forcing is required, ſo as to raiſe it from Tops of Hills, or ſuch Eminences where it is wanting.

In every Undertaking of this Nature, we ſhould firſt duly conſider what Force is required to carry a Column of Water to a certain Heighth, and then what Powers are capable of being employ'd in ſuch Force, and particularly, to contrive that all the Parts be of ſufficient Strength to hold out againſt the required Force.

Theſe are Conſiderations abſolutely neceſſary in every Undertaking of this Kind; for I have too often ſeen very ingenious Contrivances ſet on Foot, which have miſcarried in ſome Branch or other, as ſoon as they were ſet to work. As for Example, When the Force had anſwer'd the End it was deſign'd for, the Pipes of Conveyance have been ſo little conſider'd, that they have burſt and given way, at the firſt ſetting the Machine to work. In other Caſes, ſuch Pipes have been well guarded, and the Engine has done its Office for ſome Time, but throw the Multiplicity of Parts which compos'd it, the Friction has been ſo great, that ſome one Part or other has been out of Order, and the whole has ſtood ſtill. Others again, where the Motion has depended upon Tides, have at firſt done their Duty, but for want of a ſufficient Guard againſt higher Tides than ordinary, have been blown up, as they call it. In this Caſe therefore, I am of Opinion, That where our Movement depends upon the Current of a River or upon Tides, we ought not only to know how high ſuch Waters has been known to riſe, but provide againſt its riſe, 3, 4 or 5 Foot higher than ever it was known to do; for unleſs we could command the Tides, the Rains and the Fountains, we can have no Certainty: Therefore the ſaying that the Waters of ſuch a River were never higher than ſuch a Point, is nothing to the Purpoſe. And we find that many great Works have been deſtroy'd for want of this neceſſary Caution.

Again, tho' we have Mathematical Demonſtrations, that ſuch a Force will raiſe ſuch a Weight of Water to a certain Heighth, yet I am not for truſting to the Extreme in Practice; becauſe in Practice there are, for the moſt part, ſome unforeſeen Accidents which were not provided againſt in the Theory, and oftentimes occaſions a Miſcarriage, even in the beſt laid Deſigns. It is much ſafer and ſurer, if a Man is to remove a great Weight, which, perhaps, may put him to the utmoſt of his Strength, rather to move it at twice than at once; the firſt is at the Hazard of his Health, the other without any at all: So if I was to force Water two or three hundred Foot high, and I could have a Force that would do it, conſidering the vaſt Friction and Wear of all the Parts (for there will be ſome Obſtruction, do what we can to the contrary, and perhaps ſuch, as by this extraordinary Force may break and demoliſh our Works when we leaſt expect it) it is my Opinion, that in ſuch Caſes it is far more reaſonable to raiſe the Water at twice than at once; there will be leſs Strength requir'd, and leſs Hazard in every Reſpect; and if our Engines are not too much crouded with Contrivance, we may expect to find our Account in the Undertaking; but where an Engine conſiſts of a great Number of Parts, we muſt expect it to be frequently out of Order.

This particularly I obſerv'd in the Attempt of raiſing Water at *York-buildings*, by the Engine for raiſing Water by Fire; where Captain *Savory* the Inventor of it, was concern'd in the ſetting of it up. That Gentleman, tho' he had before ſet up his Engines with good Succeſs in ſeveral Places, eſpecially at *Cambden-houſe*, near *Kenſington*, was not content with the Plainneſs of them, when he undertook ſo great a Work as furniſhing the Publick with Water, but doubled every Part in the *York-buildings* Engine, and by that made it impracticable for one Man to work it; and it was liable to ſo many Diſorders, if a ſingle Miſtake happen'd in the working of it, that at length it was look'd upon as an uſeleſs Piece of Work, and rejected. And after this it had as bad Succeſs from others who endeavour'd to mend it, or improve it, as they call'd it, by altering the Captain's firſt Methods; ſo that theſe, in ſome Meaſure, loſt the Credit which his firſt Engines had got him: His firſt Sort, indeed, was not without

out a few Inconveniencies, ſuch as, That the Inſtrument, or Regulator of the whole Motion, depended upon ſeveral Parts; and in caſe that happen'd to be out of Order, the Engine was liable to blow up: But conſidering to how great Perfection he brought it, when he had the greateſt Difficulties to reconcile, it is admirable that it anſwer'd the Deſign ſo well, as his firſt Works demonſtrate: But as, always, the Stander-by may ſee more than the Gamſter himſelf, I did not think it impoſſible to mend this Engine, by ſtill making it more ſimple; and therefore directed in the Place of his Regulator, which conſiſted of many Parts, ſuch an one as was plain, and could not by any common Accident be render'd incapable of Service, till it had done Buſineſs enough to be worn out; and even then, ſhould not have any Danger attend it. This was done to the Purpoſe, as I have hinted in my *New Improvements of Gardening*, where I have given a Figure, with an Explanation of the ſeveral Parts of the Engine; from whence it will appear, That an Engine ſo order'd, without making any Variation, will be of real Uſe. But I muſt take Notice, That the Pipes thro' which the Water is forced, muſt be of Elm, as well as what is there call'd the Engine-tree, for neither Copper nor any other Mettal will do, as too many have experienc'd, and is eaſy to be demonſtrated.

In great Works, two or three ſuch Engines ſhould be employ'd at once; which will not only raiſe a greater Quantity of Water with Safety than a large double Engine (if it could be brought to Uſe) but if, thro' conſtant Uſe, one happens to want Repair, the whole Work need not ſtop, which it muſt do, if any Part of a double Engine be out of Order.

But to explain this more fully, Let us ſuppoſe that we are to raiſe Water from the River of *Thames* at *Chelſea*, to the higheſt Part of *Oxford-Square* near St. *Mary-le-bone*, which at an Hazard one may gueſs, lies above 100 Foot higher than the Level of the River, and near three Miles from *Chelſea*: Now, as there is no Ground at *Chelſea* which is high enough to make a Reſervoir upon the ſame Level of *Oxford-ſquare*, then muſt either a Reſervoir rais'd by Art at *Chelſea*, of 100 Foot high, to feed the Pipes which muſt be laid from thence to *Oxford-ſquare*, or elſe there muſt be a Force ſufficient to draw the Water from the River to the ſaid Square: Both which may be done, but the Expence will never countervail; as to the firſt, the raiſing an artificial Reſervoir of the Height before-mentioned; there is an Inſtance of it at *Verſailes*, joining to the Gardens: And that it is poſſible to drive Water up a Hill, whoſe Perpendicular is more than 500 Foot, we ſee it done at *Marly*, by continued Chains of Pumps, which are always working, by Means of large underſhot Wheels, which are ſet in Motion by the River from whence they draw the Water: There are very good Prints of theſe among the Proſpects of the King of *France*'s Palaces; but this would be a prodigious Expence: Therefore let us ſuppoſe we employ ſome other Means, ſuch as the Machine which flings up Water from the River of *Thames* to the Top of *Windſor*-Caſtle; the firſt Mover is turn'd by the Stream of the River, by which the Water is forc'd about half the required Height, and lodg'd in a Well; and from thence by Cyphons, which are work'd by a Man, it is convey'd to a Ciſtern, which is plac'd near as high as the Caſtle. There is alſo an Inſtance of an underſhot Wheel, which by working throws up Water to an Eminence of 70 Foot Perpendicular, at Mr. *Stafford*'s Seat at

Pynes near *Exeter*; but the Diſtance from the River to the Reſervoir is not above half a Quarter of a Mile. Theſe I bring as Inſtances of what can be done, and to ſhew the Neceſſity, where the Length and Height of the Way is conſiderable, of making proper Stops; for I find in the laſt mention'd Work at Mr. *Stafford's*, it was with ſome Difficulty the Undertaker could get Pipes that were ſtrong enough to reſiſt the Force and Weight of the Water: And in the great Work at *Marly*, nothing leſs than Pipes of Caſt-Iron were found capable of conveying the Water from thence to the Reſervoir at *Verſailes*, and thoſe too of a very conſiderable Subſtance. For theſe Reaſons, I think it would be adviſeable in ſuch an Undertaking, as that for raiſing Water from the River of *Thames* at *Chelſea* to *Oxford-ſquare*, That firſt there be a Reſervoir made or built near the River, ſo that its Bottom may lie between 40 and 50 Foot above the Sides, or rather be kept by Tan Wheels, which ſhould continually lie under Water, which would be influenc'd by the decreaſing as well as the increaſing Tides, and could never be put out of Order by any great Flood, the Figure of which I have publiſh'd in my Monthly Writings.

By

By this Means our firſt Reſervoir being full, we have no reaſon to doubt but that the Water in it will riſe thro' the Pipes of Conveyance to its Level, at a remote place, which we will ſuppoſe may be about ſome of the higher Grounds in St. *James*'s-Park; where, if the Ground happens not to be ſandy or gravelly, a Reſervoir may be made without much Trouble, from whence, either by a Chain of Buckets, or two or three of Captain *Savory*'s Fire Engines, the Water may be thrown up into a Reſervoir 40 or 50 Foot higher, into a ſmall Reſervoir, which would carry it to ſome Eminence of the ſame Height, ſuch as ſeems to be the higheſt Ground about St. *Mary-le-bone*, or vulgarly, *Mary-bone*, where ſhould be the grand Reſervoir, which I ſuppoſe might be made at little Expence, the Ground thereabout being for the moſt part a ſtrong Clay; by which Method I conceive ſuch an Undertaking may be compoſed at no great Expence, and be free from the Hazards which too frequently attend ſuch large Works.

But in Affairs of a higher Nature than this, where Water is only to be rais'd ten, twenty or thirty Foot, if we have a River, we may do this with either one of the *Perſian* Wheels, which at the ſame Time it is turning by the Stream, the Buckets or Troughs with which its Circle is dreſs'd will be filling, and emptying themſelves continually, the full ones diſcharging themſelves at the Top of the Wheel; which Wheel may be 20 Foot Diameter, and conſequently the Buckets may diſcharge the Water at 10, 12, 16 or 18 Foot above the River, according as the Axis of the Wheel is plac'd, higher or lower; or elſe a common underſhot or overſhot Wheel may work a Chain of Buckets ſo as to lift the Water 30 or 40 Foot high upon a Frame, and diſcharge themſelves that Height above the River or Pond, into a Receiver: Such a Wheel may be made to work Pumps to fling Water near twice that Height, but if a Stream is wanting, theſe Movements may be made by Horſes; but theſe Devices muſt have Ciſterns or Reſervoirs near at Hand, to render them uſeful. Where a Canal or Pond happens to lie higher than a River 8, 12 or 16 Foot, and is in want ſometimes of freſh Water, the Stream of the River may ſet one of the *Perſian* Wheels at work, and by having only a Trough for the Buckets to empty their Water into, which by Pipes has a Communication to ſome Part of the Canal or Pond, to be diſcharged above the Surface of ſuch Canal or Pond, and an Outlet for the Pond-water to run out, directed to a certain Height, in a Week or Fortnight's Time, according to the Bigneſs of the Pond, we ſhall find our Pond which was muddy before, become clear and pleaſant, by Means of the continual Flowing of the River-water into it, by the Wheels conſtant Supply.

DISCOURSE III.

Various METHODS relating to the DRAINING of LANDS.

AS in the laſt Diſcourſe I treated of the Neceſſity of Water in Vegetation, and of the ſeveral ways of ſupplying ſuch Places with it as are wanting of it; ſo I ſhall now explain the ſeveral Methods which are uſed for draining off the Water from ſuch Lands as are render'd uſeleſs by too great a Quantity of it.

In the Proſecution of this Diſcourſe, it will be neceſſary that I conſider two Things, *viz.* Whether our Lands are overflow'd by Freſh-water or by Salt-water, by Rivers or by the Sea; for the Management of ſuch Lands, when they are diſcover'd, is very different one from the other; for the Ground which has been overflow'd with the Freſh-water, may be much ſooner brought into a State of Fertility than a Piece of Land which has been overflow'd by the Salt-water; but both of theſe, when they have had ſufficient Time to mellow, are not only extremely vigorous in their Productions, but ſuch Land alſo ſerves as an extraordinary Manure for ſcaley or gravelly Ground, one Load being worth two Loads of Dung.

The overflowing of Land by Rivers, proceeds either from ſome Breach in the Banks of the Rivers, or from Land-waters, which fall in Abundance from the Hills after great Rains, which joining with the River-waters, cauſe them to overflow their Banks; or elſe, ſuch an Overflux may happen by extraordinary Tides.

From whence one may judge how neceſſary it is in the diſpoſing of Rivers, to make them navigable; that particular Proviſions may be made to ſecure the Banks, in ſuch Manner, that they may have Strength enough to reſiſt any extraordinary Torrent; and that they may be high enough to prevent any ſudden Guſh of Land-Waters from overflowing them, or to be above the Reach of extraordinary Tides.

As to the Firſt, We are to obſerve particularly where the Ground of which the extraordinary Banks of the River is the moſt looſe or tender; and in ſuch Parts, to line them well with Chalk or Clay, and to allow the Baſe of the Slope next the Water to be broader than in other Places, and plant ſuch Slopes with a double Row of Willow-Piles or Stakes, ſo that their Tops may appear only a Foot out of the Ground: Theſe Stakes may be from ten to twenty Foot long, according as the Height of the Bank requires: Theſe Stakes may be planted about 8 or 10 Inches apart, and will in a few Years (tho' they lie for the moſt Part under Ground) grow to that Thickneſs, as almoſt to touch one another, while their Fibers will be entangled to that Degree, that they will be capable of reſiſting the greateſt Force of the Waters. But theſe Stakes I rather adviſe to be planted in an oblique Manner, than upright; the firſt Row leaning one Way, and the ſecond Row leaning the direct contrary Way; ſo that by croſſing one another, the Spaces will be of the Figure of a *Lozenge*: By this Means the Stakes will ſupport one another.

But when we are to conſider the Height of the Banks, in order to prevent an Overflux of the River upon ſudden Guſhes of Rain or Land-waters, it will be neceſſary to ſatisfy our ſelves what Quantity of Ground has been laid under Water by Overflux of the River, and what Depth of Water ſuch Land has had upon it; that ſo when we make any of our new Cuts, we may allow Space enough in them to command ſuch an extraordinary Quantity of Water, when it may happen to come a ſecond Time: And in this we ought likewiſe to allow ſtill more Space than appears neceſſary from our Calculation, in caſe greater Floods may happen, or that Tides may flow higher than they have done before: For it is not enough to ſay, That the greateſt Floods that have been known in the Memory of Man, or the higheſt Tides, never exceeded ſuch a Height; becauſe we find every Day produces ſomething new, and the higheſt Riſe of Waters that have been known, were not expected or thought poſſible till they happen'd; and therefore Proviſions were not made againſt them. 'Tis therefore neceſſary that in all Works of this Nature we arm againſt Accidents; and in making of our Banks, tho' we can be certain that the Waters we are to fence againſt, never exceed five Foot high, yet it is Prudence to ſuppoſe, that they may riſe upon ſome new extraordinary Occaſion, a Foot or two higher than what has been obſerv'd before, which accordingly ſhould be guarded againſt. Then may we enjoy Tranquility of Mind, when we have ſo well conſider'd our Undertakings; that according to the Rules of Reaſon we have made ſufficient Defence againſt ſuch Accidents as may happen: And I am perſuaded, that the Want of Thought this Way, has not only been the Occaſion of many Miſcarriages in great Works, but has been the Ruin of many Families.

I come next to conſider the Loſſes which we may ſuſtain by the Erruption of Rivers or of the

Sea, when ever this rude Element is not diſcreetly guarded againſt, and gains an Advantage over us, by breaking thro' our Works. All the level Grounds, as well as thoſe which lie below it, muſt conſequently be loſt or bury'd in Water: Such was the Caſe at *Dagenham* in *Eſſex*, when the Breach was made there by the River *Thames*, and many thouſand Acres of good Land were drown'd, by which thoſe Gentlemen, which the Minute before enjoy'd all the Affluence of Fortune, were in an Inſtant reduc'd to Beggery; for upon the firſt breaking in of the Water, when the Breach was ſmall, and it might have been eaſily ſtopt, the Confuſion among them was ſo great, and at the ſame Time it was the Buſineſs of ſo many, that no Body undertook to put a Stop to it; ſo that it grew wider by Degrees, till at laſt it over-power'd the Skill of the beſt Artiſts; till Captain *Parry* took it in Hand, by whoſe Skill it was at length ſtopt; and the Land is now for the moſt Part recover'd. We are to Note, That in ſuch a Work of raiſing a Dam againſt the River that has broken its Way thro' its Banks, one muſt have Regard to the Back-waters, which in ſuch a Caſe, are of a Weight, at leaſt, equal, if not ſuperiour to the Preſſure of the River; ſo that one muſt not only have Regard to keep out the River at high Tides, but to have Strength enough in our Works to withſtand the Back-waters, till they are all run out thro' the Flood Glates, which ſhould be provided for that Purpoſe at Low-tides. In this Caſe we are alſo to obſerve, that the Ground was overflow'd by ſuch Water as one may rather call Salt than Freſh-water.

In *Holland*, where the Country generally lies lower than the Sea, and when the Sea is only kept from overflowing it, by Means of ſtrong Banks or Dams, there is great Care taken in ſuch Places, where the Sea drives in an extraordinary Manner againſt them, to keep off the Force of the Surges by large Piles of Timber, which they drive a convenient Depth into the Sands; ſo that the Tops ſtand ſeveral Foot above the higheſt Tides, by which Means the Violence of the Sea is broken before it can reach the Banks: But yet ſometimes the Tides are ſo high, and the Sea ſo ſtrong, that neither the Piles nor the Banks are able to reſiſt the Fury of the Waves, but they are forced to ſubmit, and the Country is overflow'd, to the Loſs of many Lives: But always upon the Fall of ſuch a Tide every Man within Reach of the Place attends, to repair the Damage; and in a Tide or two the Breach is repair'd, by driving down Piles of Timber, and filling up the Vacancies between them with Carts or Carriages fill'd with Stones, or ſuch like heavy Bodies.

But when this is done, we are to conſider that the Country ſtill remains overflow'd, and therefore our next Buſineſs is to drain off the Water, which may be done ſeveral Ways. The firſt Method which is moſt generally practis'd, is by a Wheel, which is ſet to Work with a Wind-mill: This Wheel is about 13 Foot diameter, reſembling a Wheel with Spokes only; but in lieu of Spokes they are Boards of 14 or 16 Inches wide: This Wheel turns between two upright Plains of Boards, ſo that there is not an Inch Space on either Side between the Wheel and the Plains of Boards; ſo that as the Wheel turns in the Water, the flat Boards which ſtand in the Room of Spokes, bring up the Water as high as the Axletree, and diſcharge it over the Banks; ſo that whenever the Mill goes, it carries off a large Stream of Water without Intermiſſion: This Engine is chiefly in Uſe among the *Hollanders*, and I have alſo ſeen the ſame in the *Lincolnſhire* Fens.

Or, if the Banks are very high, the Wind-mills may work either Pumps or Chains of Buckets, to diſcharge the Water.

But let us ſuppoſe our Caſe to be the moſt difficult that can be, ſuch as having a great Quantity of overflow'd Land encompaſs'd with Hills, ſo that our Wind-mills can be of no Uſe; nor Pumps, nor Chains of Buckets can reach to diſcharge the Waters over the Hills: In this Caſe, I know no better way than to uſe the Crane, which is infallible, if we can find a lower Ground on the Out-ſide of the Hills; for if our Hills were never ſo broad, we might bring a Crane to act ſo as to diſcharge the Water over them. For this End we may uſe either Elm or Fir Pipes, of three or four Inches Bore; placing at the very higheſt Part of them a Turn-Cock, by Means of which, the Range of Pipes which make up the Crane, may be fill'd with Water; firſt ſtopping them at each End. When this Range of Pipes is once full, and the Turn-Cock ſhut cloſe, we muſt firſt unſtop that End of the Crane which lies in the

Water, and then the other; ſo will the Water flow in a continued Stream from the Crane, as long as it has any Water to diſcharge.

But let us conſider in the next Place, that, tho' by Flood-Gates, or Mills, or Cranes one may lay dry an overflow'd Ground in ſome Sort, yet perhaps ſome of the lower Parts of ſuch Land may hold a ſtanding Water; ſo that we muſt go another Way to Work to bring the Ground to Uſe; which muſt be done by cutting of Canals, Dykes or Ditches of ſuch a Depth, Length, and Breadth, as may contain the Water, and give an eaſy Communication to every Part of the Ground. In this Work we ſhall find, that beſides the Room which we make to hold Water in ſuch Canals or Dykes, the Earth which we take take out of them will raiſe the other Land in ſuch Proportion, as yet to give more Room for the Water, as it is the Caſe in *Holland* and other Parts, where Water is in too great Abundance.

Our Land being once drain'd, we come next to conſider what Methods ought to be taken to improve ſuch Ground, and make it produce profitable Crops.

I obſerve, that when we firſt diſcover Land which has been overflow'd for a great Number of Years, it is generally black for a good Depth, and conſiſting of very fine Parts, which being turn'd up, and lying expos'd to the Air and Sun for ſome Time, it becomes mellow and fit for Action: But if it has been overflow'd with Salt-Water, the Salts will riſe to the Surface by the Heat of the Sun; and then we may pare off the Surface when it is throughly dry: This Surface will be well worth our while, to be carted to ſome of our Ground which is the leaſt fertile: It is excellent upon a Clay or upon a Scaley Ground; but ſhould be always more moderately uſed upon light, than ſtiff Soil: But the Ground, where this is put, muſt be plow'd twice or thrice, in order to mix the natural Soil and the drown'd Earth together. When this is done, we may ſow it firſt with Turneps, and it will afterwards bring excellent Corn. But our new drain'd Land will be much too luxuriant for Corn, till it has had Time to fallow, and has brought a Crop of Cole or Rape, or ſuch like ſtrong growing Vegetable.

Dis-

DISCOURSE IV.

Of the ſeveral PARTS of PLANTS and their Reſpective OFFICES, with Regard to Vegetation.

IT is neceſſary, in the firſt Place, to conſider that every Tree conſiſts of two principal Parts, *viz.* The Root, and the Body. The Buſineſs of the Root is to act in the Ground, while the other is to act in the Air: And both theſe Parts are capable of being alter'd and chang'd, by ſhifting their Stations. The Roots being expos'd to the

Air, will produce Buds, Leaves, Flowers and Fruit; and the Branches, which are now enjoying the Air, being bury'd or lay'd into the Ground, will divert themſelves from their preſent Method of Growth, and produce Roots and Fibers: This is Evident from the Experiment I have publiſh'd ſeveral Years ago, relating to the reverſing of a Tree; by firſt laying down the Head of a Tree in the Ground, and letting it ſo remain till it has taken Root; and then digging up the original Root, and expoſing it to the Air, while the Head, which has now taken Root, is capable of nouriſhing the whole Plant.

This Experiment ſhews us, That the ſame Principles of Vegetation are in the Roots and in the Branches, and that their different Manner of Acting proceeds only from their different Situations, the one being govern'd by a Body, light as Air; the other by a Body denſe as Water or Earth.

Every Root, as well as every Branch of a Tree, conſiſts of two principal Parts, *viz.* Sap-Veſſels, which extend themſelves through the whole Body; and ſpongey Parts, which encloſe the Sap-Veſſels: Theſe in the Trunk, or Branch, or Root of a

Tare, are ſo diſpos'd, as if one was to ſtick Quills or Straws in a Spunge, the Quills or Straws repreſenting the Sap-Veſſels, thro' which the Vegetable Nouriſhment circulates, when it is taken in by the Root from the Earth, or from the Leaves by the Air. The ſpungey Parts have alſo a Communication with theſe Veſſels, ſo as to keep them open in ſuch a Manner, as to continue them in a Capacity of receiving the Sap; for without theſe ſpungey Parts, the Sap-Veſſels would ſhrink and dry up; ſo that no Juices could move in them: The one is neceſſary to maintain the other, as the ſeveral Coverings are neceſſary in Animals, to ſupport and defend the Blood Veſſels.

The ſpungey Parts of Plants are moſt aparent in the Pith and Bark of Trees; the Bark, by being of this Texture, is capable of receiving its Nouriſhment from the Air, as well as of diſcharging ſuch ſuperfluous Moiſture or excrementatious Juices as are neceſſary to be voided, to keep the Plant in Health; and as the Bark has a cloſe Communication with the Pith of a Tree, ſo ſuch Juices as are naturally requir'd to be diſcharged from the Pith, have a Freedom of Paſſage thro' the Bark; or the Benefit which the Bark receives from the Air, is communicated to the Pith.

The Bark and the Pith are ſo much of the ſame Nature, that while the Bark is tender and full of Juices, ſo is the Pith; and when the Bark grows hard and woody, ſo does the Pith likewiſe; ſo that we never find the Pith of any Moment or Uſe, but in young Shoots, where the Bark is tender; and we ſeldom can obſerve any Pith, but what is tending to Rottenneſs, in a Shoot of three Years old.

The Buds of Trees have their firſt Riſe in the Pith; they are there fram'd, and as they become fit for Action, by being furniſh'd with every neceſſary Part for Vegetation, they are forced along certain regular Chanels, till they meet the Air at the tender Bark, thro' which they make their Way; and would drop to the Ground, if they were not reſtrain'd by a Number of Sap-Veſſels, which ſerve as ſo many Roots to nouriſh them from the Body of the Tree. The Buds I ſpeak of are, in every Reſpect, as perfect as a Seed, or rather more ſo; for a Bud contains a whole Plant roll'd up in it, and has, for the moſt Part, its

Juices ſo well digeſted, as to come ſooner to bear Fruit, than that Plant which is wrap'd up in a Seed. We are to obſerve, that the Difference between a Bud and a Seed is, that a Seed conſiſts of Lobes or Ear-Leaves, which include the young Plants, and ſerve to give the little Plant, they incloſe, the firſt Stamp; by teaching it what Kinds of Juices it ought to draw from the Earth for its Nouriſhment: But a Bud has no Occaſion of ſuch Ear-Leaves, becauſe it takes Root immediately in the Body of the Tree, where the Juices are already fit for it: So a Seed takes Root in the Earth, and a Bud takes Root in the Tree, and both theſe are produc'd by the ſame Tree, but in different Manners. As they are to be of Different Uſes, Seeds are to multiply the Species, and within the Compaſs of certain Laws of Nature, have Liberty to ſport, and produce their own Species with Variety of Complections; while Buds are conſtant to the Mother-Tree, and are exact Repreſentatives of the Plant that produc'd them. This ſeems abſolutely neceſſary in Nature, as well when we conſider the Offspring of Plants from Seeds, as when we have Regard to Animals, that they ſhould not all have exactly the ſame Faces: For as the Faces are ſo made, as to be capable of being touch'd with Variety, ſo are they recreated and refreſh'd by it, and remain longer perfect, than if each of them was continually to be employ'd upon a ſingle Object. As for ſuch Plants as are produc'd from Seeds, they are all of them ſome Way different from one another, either by ſome little Variation in the Colour of the Flower, the Taſte, or Time of ripening of their Fruit, the Flower or Figure of it, or ſome Difference in the Shape and Colour of the Leaves: So in Animals, we find that the ſame Female will produce great Variety, her Offſpring differing from one another, either in Colour or Marks, and ſome more tractable than others, ſome more lively and brisk, *&c.* But none of this Offspring will bear exactly the Face of the Mother, or be exactly like the Sire: But the Reaſon of this we ſhall examine in another Place.

But as I have ſaid thus much of the Seed, I am next to ſet forth the Benefit Nature has given to Plants, to make up their Deficiency in the Want of local Motion: And this is particularly inſtanc'd as in the Production of Buds in Trees, which may be transferr'd from one Tree to another; and by Inoculation will take Root in the Tree they are fixt upon; and ſtill the Shoots of the Buds will produce the ſame Fruit as the Mother-Tree which they ſprung from: So that what I have before obſerv'd, of the Creation of Buds, and Difference between them and Seeds, is here confirm'd; and ſhews us, that they were made on Purpoſe to ſuport the Reputation of the Mother-Plant, any Where, and every Place, poſſeſſing ſtill the ſame Qualities: So that one might ſay, the ſame Plant may be every where at the ſame Time. For if we bring an Example from the Golden-Pipin, which is a Plant well known, the Seeds of it will bring Trees, that will produce different Sorts of Apples; but the Buds of the ſame Tree, if they are grafted upon either a wild Crab, or any other Sort of Apple, theſe Buds will ſtill produce the ſame Sort of Fruit with the Tree they were taken from. And ſo the *Newington*-Peach, or any other good Peach, is budded or inoculated either upon an other Peach, or upon a Plumb, or ſuch other Plant whoſe Juices are natural enough to it, to feed it well, it will preſerve its original Virtue. What I ſhall remark from theſe Obſervations is, That a Bud of a Tree is the Means by which a particular Fruit, or Tree of Merit, may come to poſſeſs the whole World at one Time, which is a ſufficient Recompence for its Deficiency in the want of Liberty of moving from Place to Place, as Animals do.

But Buds are of ſeveral Sorts, and are ſuch, as are either immediately profitable, or unprofitable, *i. e.* Either Leaf-Buds, or Bloſſom-Buds. We may know the Difference between theſe Buds in moſt Sorts of Fruits, before they open, by obſerving that the Leaf-Buds are long, thin, and pointed; but the Bloſſom-Buds are ſhort and turged: The Juices in the firſt are more fluent and aqueous; and the latter are more digeſted and gummy: But both theſe Sorts of Buds proceed from the Pith of the young Wood, and are diſpos'd for different Offices, as the Plant or the Branches which produce them, are more or leſs vigorous: It is obſervable, that the moſt Vigorous bring Leaf-Buds; and thoſe that are ſmaller, and ſeem to be leſs nouriſh'd, produce Bloſſom-Buds.

The Buds of Trees are put into Action, and are explain'd into Branches, when the Temper of the Air is ſuch, as to render the Sap or Juices of the Plant, of ſuch a Degree of Fluidity, as that it may paſs through the Veſſels without Interruption: And this Sap, in different Plants, is of very different Kinds; in ſome it is ſet at Work with a very ſmall Share of Warmth; in others, 'tis of that Nature, as to require extraordinary Heat to put in Motion: The Conſequence however is, when the Sap is ſufficiently fluent, that it fills the Buds, and by Degrees are explain'd into Shoots and Branches; every one of which is properly a Tree growing upon an other Tree; which makes it practicable to cut off Branches from any Tree, where we pleaſe, without deſtroying the Tree: But if a Tree was one entire Body, as the Body of an Animal, the cutting of the Branch would endanger the whole.

All Buds of Trees are guarded with Leaves, which are uſeful to help the Bud in its Germination; for we find that if we ſtrip a Shoot of its Leaves, the Buds will not grow; the Leaves of a Plant are poreous and ſpungey, and imbibes a Moiſture from the Air, which helps to nouriſh both the Buds and the Plants they grow upon: In ſome Plants thoſe Leaves are Annual, in other Perennial; in thoſe Plants where the Leaves are Perennial, the Juices are of that Nature, as even to act upon their Plants in the colder Seaſons, and occaſion them to grow in Winter: But where the Leaves are Annual, they fall from the Plants aſſoon as the Juices of ſuch Plants are conduced by Cold, and have finiſhed their ſeaſonable Shooting. The Account we have of the Tree in the *Madera* Iſlands, which has Water continually droping from its Leaves, even in ſo great a Quantity as to furniſh the Inhabitants with Water, ſeems to determine, that the Uſe of the Leaves of Plants is to conduce the Air; and perhaps this Tree, in a particular Manner, may be of a colder Nature than other Plants, and therefore the Air about it may be condenſed much quicker than that about other Trees. It is remarkable, that Countries which abound in Wood, are more ſubject to Rains than bare plain Countries; and that Leaves ſerve to nouriſh the Tree they grow upon, is certain, becauſe we may kill the moſt vigorous Tree, if we ſtript it of its Leaves while it is growing; for the Leaves help to keep up the Circulation of the Tree; they are like Feathers to Fowls, and Hair or Wool to Cattle, which if we were to ſtrip them off entirely, we ſhould certainly deſtroy them.

But as it has been obſerved, that Buds are the Occaſion of increaſing the Parts of the Tree under Ground; they are fram'd in the Pith of the Root, as well as in the Pith which we find in the Parts of a Plant above Ground; thoſe that are form'd in the Root, are impreſt with the Form of the Root when they are put in Action; and ſo thoſe Buds which are form'd in the Branches are alſo model'd for Branches, when they begin to act, but in their Principles are both the ſame: For if we expoſe the Roots of a Tree to the Air, after allowing it ſome little Time to be acquainted with the Element, it will put out its Buds in ſuch Sort, as they will produce Leaves: And if we lay down a Branch of a Tree in the Earth, after it has had a due Time to reconcile it ſelf to that Station, thoſe Buds form'd in the Pith, when they begin to move, will, inſtead of Leaves, or Flowers, or Fruit, which they would have produc'd if they had rais'd in the Air, will now bring forth Roots, and from them others. Now, as I have obſerv'd before, that Pith, of Conſequence, is only found in the younger Shoots; ſo, if we would increaſe a Tree by Layers, thoſe Layers muſt be of the young

Shoots, where this Pith is perfect; or elſe there will be wanting thoſe Seeds or Buds which are ſo neceſſary to produce Roots; and not only our Labour will be to no Purpoſe, but our Time will be loſt in the Diſappointment.

When our Roots are fram'd, we find them to conſiſt of two principal Parts, as I have mention'd, *viz.* The Sap-Veſſels, and the Spungy-Parts. Theſe Roots, like the Branches above Ground, branch themſelves in the Earth: And 'tis my Opinion, that every Tree has the like Quantity of Roots, that it has Branches; and that every Root has a particular Branch, which has Connection with it. The extream Parts of the Roots are not much unlike Earth-Worms in their Make; they are always ſmaller than the reſt, and are diſtinguiſh'd by the Name of *Fibres*: Theſe are the Mouths by which every Plant is fed, and receives Nouriſhment from the Earth. And in every Plant, which is in a natural State of Growth, it is obſervable, the Roots always ſhoot before the Buds above Ground; and in the time of their Growth, draw in Nouriſhment for the Plant they are to maintain.

As I have now ſet forth the ſeveral Parts of a Plant, with regard to its Increaſe of Stature; ſo it would be neceſſary I ſhould ſay ſomething concerning its Circulation of Juices; which in General I ſhall hint at in this Diſcourſe, and leave the particular Inſtances of it to the next, where I ſhall ſhew the Uſe of that Doctrine. As I have already deſcrib'd the principal Parts of a Tree, it appears, That the Fibres of the Roots draw ſuch Nouriſhment from the Earth, as is afterwards diſtributed to the lower Parts, through the Sap-Veſſels; which are ſo many Arteries and Veins thro' which the Blood is circulated in Animals: But theſe Veſſels are ſo fine, that nothing which is ſo denſe as Water, can paſs thro' them, unleſs ſuch watery Parts as are receiv'd by the ſpungeous Body which encloſe them, and have a Communication with them, are rarify'd to a very fine Degree; and then the Tree is render'd capable of Growth, and is in Action every where: For we find by Experience, that if we take a Tree in the coldeſt Part of Winter, and lay its Branches cloſe to a Wall which is artificially warm'd, the Parts which lie cloſe to that artificial Heat, will begin to open and explain themſelves in a few Days, and by their Motion will ſet the Juices of the whole Tree in Motion: Which, particularly, I ſhall explain in the Diſcourſe where I treat of artificial Heats.

It remains, however, that I ſpeak of the Flowers and Fruit of a Tree in this Diſcourſe, in order to deſcribe all its Parts. The Flowers or Bloſſoms, I have ſaid before, are form'd in the Buds, while they are in the Pith; and conſequently, ſo is the Fruit or Seed: The Flower which includes the Fruit, is a Plant growing upon another Plant; for whether a Flower be Male or Female, or Androginous, it is ſure to fall from the Tree when it has done its Office, as a Male, by impregnating the Female Parts; or, as a Female, by producing a Fruit with Seeds.

What I call Male Flowers, are ſuch as the Catkins upon the Hazel, *&c.* which only bring Stamina with their Apices; and whoſe Apices, when they open, diſcharge a Duſt or Powder, which ſerves to fecundate the Female Flowers, and when that Office is perform'd, drop from the Tree.

What I call Female Bloſſoms, are ſuch as contain the Ovaries or Egg-Neſts, or Seed-Neſts, which, when they are impregnated by the aforeſaid Duſt or Powder, bring perfect Fruit: Theſe Female-Parts are, for the moſt part, more adorn'd than the Male-Bloſſoms: Both theſe, as far as I have obſerv'd, are always to be found upon the ſame Tree.

Thoſe Flowers, which I call Androginus, are partaking of Male and Female Parts; each Flower contains both thoſe Parts which are Male and Female, and have a proper Defence from the Weather, while the Female is perfectly impregnated; and then all the Parts which have finiſhed their Office drop off: Such a Flower we ſuppoſe a Lilly or a Tulip, it conſiſts of Petalls or Flower Leaves, which are to ſhelter the more nice Parts; they have viſible Roots, which take hold, or take Root, on the Summit of the Foot-Stalk, and upon them the Stamina take Root, and the Reſult or Sum of the Stamina, are the Apices which produce the Male-Duſt; all which Parts, drop aſſoon as they have perform'd their Office of Generation: In the Center of theſe is plac'd, either the *Piſtillum* or *Stylus*.

DISCOURSE V.

Of the ANATOMY and MOTION of JUICES in PLANTS.

AS the preceding Diſcourſe treated of the ſeveral Parts of Plants, and their reſpective Offices, with regard to Vegetation, ſo it will be my Buſineſs, in this, to explain the Uſe of that Knowledge.

We have obſerved, that every Plant has a Continuity of Veſſels throughout the whole Body, as well adapted to the Circulation of

Juices, as any Animal whatever; and that all Plants have Juices which flow in them, when they are duly rarify'd by a proper Degree of Warmth, is beyond Contradiction; and therefore the Obſervation I have offer'd concerning the Reverſing a Tree, and making the Branches become Roots, and changing the Roots into Branches, is a capital Evidence, that the Sap does circulate: As alſo confirm'd in another Experiment I made nine Years ago, by inarching four Branches of an old Dwarf Pear-Tree, into four young Pear-Stocks, which being well join'd and united, I ſaw'd off the old Tree near the Root, and ſupported it by Wedges for a Year or more, and by theſe Means, every Part of my old Tree, which before was ſo ſickly as to bring its Fruit little larger than Hazel-Nuts, had now gather'd ſo much Strength from the young Pear-Stocks, as to ſhoot freely and bear large Fruit; thus by the Circulation of the vigorous Juices of the young Pear-Stocks, through the whole great Pear-Tree which was decay'd, it recover'd its full Strength and Vigour, notwithſtanding I had diſengag'd the old Tree from its own Root. Thus, without more Inſtances, we are ſure of the Sap's Circulation; unleſs I may obſerve enpaſſant, that the Diſtemper which ſhews itſelf in the yellow and white Variegations of the Leaves of the common white Jeſſamine, and ſeveral other Plants, may be communicated to every Plant of the ſame Tribe, by inoculating only a ſingle Bud of the other variegated Kind into the others, which have plain green Leaves; and tho' the Bud does not live yet barely by the Application of it to the healthful Tree, we ſhall find the yellow Blotches, or Variegations of the unhealthful Bud, communicated to every Part of the healthful Plant. Juſt as it happens, when a Man has had the Small-Pox inoculated upon him, his whole Maſs of Blood will become infected with the Poiſon. The Circulation of the Sap being thus certain, as the Circulation of the Blood, it next follows, that I obſerve, That ſome Plants which are ever-green in the Winter, are Analogous to thoſe Animals which enjoy all their Faculties the whole Year about; and thoſe which die down to the Ground, or drop their Leaves at the Approach of the Winter-Seaſon, and revive again in the Spring, are like thoſe Animals which ſleep during the Winter; but yet there is Life in all theſe throughout the whole Courſe of the Year tho' not the ſame Degree of Active

Life; and it is even to be underſtood by the Touch, when the Leaves are fallen from a Tree, whether it is Alive or Dead; the live Tree will feel cold and ſmoth in the young Shoots, and the dead Tree will be rough to the Touch. In ſuch Plants where the Juices are the moſt condens'd in cold Weather, the Sap becomes Glutinous, or of a Gummy Nature, in ſuch Sort, as to preſerve the Plants from Putrifaction, and ſo is ſeeming Analogous to the Juices in thoſe Animals which ſleep in the Winter, which are not ſubject to putrify: For I have had an Opportunity of making the Experiment with the Halcion or King-Fiſher, in the hoteſt Weather in the Summer, which for a Week after it was dead, had not the leaſt Sign of Putrifaction, or any ill Scent, tho' it was difficult at that time, to keep any kind of Fleſh among the Butchers, or Poultery 24 Hours, without becoming rancid: And as the King-fiſher is aſleep, as well as the Plants I ſpeak of, ſo I ſuppoſe its Juices, as well as thoſe of all ſuch Creatures, as are lay'd up in the Winter, are in a particular Manner diſpos'd to preſerve them from putrifying, while they are at Reſt; which Reſt, is ſo like Death, that one muſt have good Judgment to diſtinguiſh between one and the other:

And it is with theſe Animals as it is with Plants, that if, in the cold Seaſon when they are lay'd up, we bring them near a Fire, or put them into ſome warm Place, the Heat will put their Juices in Action, as they are naturally in the Summer-Seaſon: This we find in the Snake, the Batt, the Urchin or Hedghog, and the Tortoiſe. But we have ſome Plants, whoſe Juices are flowing as well in Winter as in Summer; the Ever-greens eſpecially, are growing, and flowering, and ripening their Fruit even in the coldeſt Time of the Winter, and are the neareſt at a Stand about Mid-ſummer; and, indeed, ſo are moſt Plants. What I mean by this Stand, is, that they have about Mid-ſummer finiſh'd their firſt Shoot, or Summer-Shoot; that is to ſay, the Fund and Nouriſhment which the Root had collected from the Earth in the preceding Autumn and Spring, is now expended in the new Shoots; and ſo the Roots are now encreaſing themſelves, and are preparing to take in freſh Supply from the Earth, in order to ſhoot afreſh in the Autumn. At this Stand, it is much the beſt Time to remove Trees; becauſe they will then ſtrike freſh Roots in two or three Days; whereas if we tranſplant them late in the Autumn, when the Juices are thicken'd, they will not make any new Roots till the Spring following; and then the Plant is employ'd in making new Roots, when ſuch Roots ſhould be already made and ſtored with a Fund of Nouriſhment to feed the Shoots which are to be made above Ground: When this is the Caſe, the Shoots of that Summer are always poor and weak; but by Summer-planting, our Trees preſently take hold of the Ground, and their Roots are plentifully furniſh'd before Winter, and ſo are capable of producing ſtrong Shoots the Spring following.

We may learn alſo, by the Knowledge of the Sap's Circulation, in the Manner I have ſet down, that no Time is ſo proper to tranſplant any Tree, as when its Juices are active, and have a Tendency to act particularly in the Root; but then we muſt take eſpecial Care to preſerve the Roots from drying, while we remove our Plants from one Place to another; and likewiſe we muſt obſerve, that the Earth we plant them in, be cloſely fix'd to the Roots at the Time of Tranſplanting; for otherwiſe, the Air, which will get into the Creviſes of the Earth, will dry and harden them;

to prevent this, ſee the Diſcourſe concerning the tranſplanting of Trees.

Another Thing, which we may learn from the Syſtem of the Sap's Circulation, is, that when we remove any Tree, we are not immediately to rob it of its Head and Branches, as is commonly practiſed; for while a Tree with its Branches conſiſts of ſpungey Parts, which imbibe Moiſture from the Air and Dews; the Moiſture and Nouriſhment which the Tree receives by thoſe Means, is aſſiſting to the Support of the Tree, and to the framing of new Roots; and when that Work is over, after tranſplanting them, it is neceſſary we may thin the Head, or lop off ſome of its Branches, that the reſt may be better nouriſh'd. In this Operation we muſt have regard to what I have mention'd concerning the Buds of Trees, that they are, as it were, ſo many Seeds which are to grow upon the Trunk or Body of the Tree; and the Caſe is much the ſame, as if we were to ſow Seeds upon a Piece of Ground; that is, if we ſuffer the Ground to be overſtock'd with Seeds, the Plants will be weak thro' the Want of Nouriſhment; but if we ſow the Seeds at a due Diſtance from one another, they will then have a ſufficient Share of Nouriſhment, to make them ſtrong Plants. So the Buds of a Tree, if they are too many in Number, will, for want of Nouriſhment, become weak: But when the Judgment of a Gardener can prune a Plant, ſo as to leave a proportionable Number of Buds upon it, to be well fed by it, they will then be vigorous in their Growth: Which in Forreſt-Trees is to be deſired, but in Fruit-Trees it is otherwiſe; for, as I have obſerv'd before, the luxuriant Shoots are fed by the more watery Parts of the Tree, and ſuch indigeſted Juices are unfruitful, and by pruning, many of thoſe watery Juices are loſt, and the Remainder is uſeful in the Production of ſmaller Branches, but then they are ſuch as bear Fruit. We are to obſerve, all this while, that the cutting off a Branch from a Tree, while its Juices are in vigorous Action, does not hinder the Circulation of Juices in the other Parts, no more than the cutting off a Leg or an Arm from a Man would prevent the Circulation of the Blood in the other Parts of the Body. But I have, in the former Diſcourſe, given ſome Account of the Difference between Animals and Vegetables in this Reſpect. I may obſerve however, in this Place, that we have ſome Shell-Fiſh which have the Power of renewing a loſt Limb, as well as Vegetables; I mean the Lobſter, and Sea-Crab, which, according to the Accounts in the Memoirs of the Royal Accademy at *Paris*, will, in a few Weeks after they have loſt one of their great Claws, renew it again; which is the reaſon (thoſe Gentlemen tell us) that we ſo frequently find the large Claws of Lobſters unequal in their Size and Figure. But the tranſplanting of Wall-Fruit-Trees, without pruning off their Tops till they have ſtruck Root, is yet a common Practice among Gardeners, and they find their Account in that Way of planting; but yet when they make Plantations of Forreſt-Trees, they as ſurely cut off their Heads at the Time of tranſplanting: And tho' they are almoſt as frequently convinc'd of their Error in the Death, or languiſhing Condition of ſuch Trees, yet they proceed on in their Way, without conſidering how much their Practice is contradictory one Part to the other. If they find a Benefit, by planting Wall-Fruit-Trees with their Tops on, why ſhould they not expect the ſame Advantage in planting Standards with their Heads on? By the one Way we have rarely a Miſcarriage, and by the other we ſcarcely meet with any thing elſe:

For if ſuch lopp'd Trees happen to live, they are ſo long before they recover themſelves to ſhoot vigorouſly, that to ſow Seeds at the Time when ſuch Plantations are made, the Seedling-Plants will outſtrip them in ſeven Years Time, or ſome Sorts of Trees in five Years, as I have experienc'd: But it is quite different with thoſe Plants which are tranſplanted in the Summer with the Heads on, which flouriſh the following Year, as if they had not been remov'd at all, and in the hotteſt Weather have no more need of watering than Trees that have been planted three or four Years; for while the Sap is fluent, the whole of it which is in the Body, as well as in the Branches of the Tree, is turn'd to the framing of new Roots, to ſupply the Deficiencies of thoſe which are loſt by the taking up of the Tree, all which while the Buds above Ground ſtand ſtill, and only have bare Subſiſtence to keep them alive till the Roots are ſufficiently ſtrengthen'd, and are in a Capacity of filling themſelves with ſuch a Fund of Nouriſhment, as is convenient to furniſh them with full Allowance. Thus the Autumn-Shoot is generally prevented, and ſo the Tree is in a Capacity of ſhooting ſtrong in the Spring.

But ſuppoſe theſe Trees I ſpeak of, are ſuch as I may compare to the Animals which ſleep in the Winter, then one would ſuppoſe, that the pruning of them is beſt at ſuch a Seaſon when their Juices are moſt at reſt; and it certainly is ſo, if we can guard the wounded Parts from the Froſts; for tho' the Juices at that Time are thicken'd in Plants in ſome Degree or other, yet their Coverings are ſuch, as will prevent their receiving Injury from the Froſt; but when they are laid open by pruning, and become ſubject to the Froſt, ſuch a Branch or Limb as is wounded, is always ſubject to decay by Severity of Weather; therefore it is neceſſary where the Wound is great, to plaiſter it with ſuch Gums as I ſhall ſpeak of in the Diſcourſe of Pruning. It is obſervable, that ſuch Trees as are Natives of *England*, or were brought to us from Countries which were not of the warmeſt Latitudes, ſuch as Pears and Apples, are commonly prun'd in the Winter; but thoſe Fruits which come from the warmer Climate, ſuch as the Stone-Fruits, which are ſubject to Gum by wounding, are left unprun'd by our Gardeners, till juſt before their Sap begins to move towards Germination in the Spring, ſo that Froſts may not have

Power over them, and the Flux of the Sap immediately following, may heal their Wounds: We muſt obſerve too, that the Reaſon why Apples and Pears are not ſo ſubject to mortify by Winter Pruning, as the Stone-Fruit, is, becauſe their Juices are not ſo unactive in the Winter; for it is common to ſee them fling out their Bloſſoms in the colder Seaſons, but we never ſee this in the Stone-Fruits, unleſs they have artificial Heats.

Upon the Foot of what I have ſaid concerning the Buds of Trees in my former Diſcourſe, I now come to ſpeak of Inoculation which may be perform'd either in *March*, *April*, or *July*, in ſuch Plants where the Bark will riſe, and the Sap is fluent at thoſe Times; but while the Stock which we are to inoculate upon is making its Shoots, it is by no Means proper, becauſe the Shoots which have already begun to grow, draw away all the Sap from the Strange Bud, and ſo it cannot be ſupported till it can join with, or take Root in the Stock. Thus the Motion of the Juices in the Stock is to be conſider'd, when we deſign to inoculate a Bud into it.

In Grafting, it is neceſſary to perform that Operation a little before the Juices in the Stock are beginning to move fluently, that the Buds in the Cion, and thoſe in the Stock, may be working together; for the ſame Reaſon that I have given in the Article of Inoculation. And we muſt remark, that thoſe Plants which abound in Aqueous Juices, and conſequently have their Sap conſtantly, in ſome Degree of Fluidity, ſuch as Apples and Pears, will beſt bear Grafting early, and the Stone-Fruit, which have more Gummy Juices, will beſt proſper by Inoculation.

It is likewiſe to be remark'd, that all Cuttings of Plants, which abound in Aqueous Juices, will ſooner ſtrike Root in the Ground, than the Cuttings of ſuch Plants, as have their Sap of a more Gummy or Rozinous Nature. I have obſerv'd before, that when a Plant abounds in Watry Juices, its Shoots, will be Luxuriant; and, on the contrary, when the Juices are Gummy, it will produce ſuch Shoots, which, tho' they are ſmall, will be fruitful: This is remarkable in many kinds of Fruit-Trees; Apples and Pears, for Example,

for

for the moſt Part, muſt have Shoots of one Year, before ſuch Shoots can form their Buds for Bloſſoms or Fruit; but Peaches, Apricocks, and Plumbs, bring their Fruit upon the Shoots of the laſt Summer, through the Gumminеſs of their Juices. So that it is difficult to raiſe Cuttings of ſuch Trees, whoſe Juices abound in Gum; but the Cuttings of ſuch Trees, as conſiſt chiefly of Watry Juices, ſtrike Root preſently, and put forth their firſt Fibres, for the moſt Part, at thoſe Places where the Buds are which we bury in the Ground, provided they are Leaf-Buds; but where ſuch Buds are ripen'd into Bloſſom-Buds, there is no altering of them, and the Cuttings will not ſtrike Root; for they are too much perfected, in every Reſpect, to alter their Property; the Pith, as I have obſerv'd in the former Diſcourſe, has done its Duty, and is incapable of altering its Work.

But we have yet this Advantage, where the Juices of Plants are more inclining to be Gummy, we may lay the young Shoots into the Earth, where, after a due Courſe of Time, the Moiſture of the Earth will alter their Property, and diſpoſe them to ſtrike Root; the Mother

Plant, all the while, keeping them alive, 'till they can undergo this great Change. This is another Conſequence of the Circulation of Sap.

The Seaſon of planting Cuttings of Trees, or of making Layers from them, which bring the hardeſt young Wood, is always when the Juices are moſt at Reſt; becauſe the Buds, which we bury in the Ground, being then unactive, have Time to be prepar'd by the Moiſture of the Earth, and to be chang'd inſenſibly, *v. g.* before the Sap is fluent, and thoſe Parts which acted before as Roots to the Buds in the Tree, are reconcil'd, upon the firſt Motion of the Sap, to do their Office as Roots in the Earth, the Spongey or Fungous Part of the Cuttings, ſupplying the Office of the Lobes or Ear-Leaves of the Seed, *viz.* to feed them 'till they can be wean'd to receive a Nouriſhment from the Earth; and the Parts which are under Ground, may be the firſt in Action, becauſe they are ſhelter'd from the cold Winds, which often happen when the State of the Air is warm; and conſequently, when the Body of Air is warm, the Earth, which conſiſts of Parts contegious, muſt be warm likewiſe; which one may beſt judge by the following Ex-

periment;

periment. In *Germany*, there is a large Room warm'd, by having the Vault, underneath it, lin'd with Pieces of Iron, which are ſo laid together, that every one touches another; ſome of theſe are Pieces of broken Cannon, which are pretty large, others are as ſmall as Hob-Nails or Horſe-Nails: At one End of theſe, is a Fire, which by heating the Irons next to it, the Heat is communicated to all the reſt, which, in a Body, hold the Heat for a long Time, which is communicated to the upper Room: So when the Surface of the Earth is heated, we ſuppoſe the next Parts below it are concern'd, and the next below them, and ſo on, in ſome Degree or other.

But we ſay, the Buds of a Plant will preſerve its firſt Qualities, tho' it is apply'd to a Tree of different Qualities; that is, that the Bud taken from a Golden Pippin-Tree will produce a Branch which ſhall bear Golden-Pippins, tho' it be inoculated upon a wild Crab-Stock, whoſe Juices are ſower and harſh, and far different from thoſe of the Golden-Pippin, which are ſweet and high flavour'd. This is no more ſtrange, than that ſeveral Off-Sets from the ſame Auricula, or Ranunculus, or Tulip, ſhall bring the ſame Flower in all its Properties, tho' they are planted in different Soils: For I have obſerv'd before, that every Bud, of a particular Tree, has the particular Stamp of that Tree in it, which is unalterable; and this Bud, whether it is growing on the Mother-Tree, or is join'd with a Crab of the ſame Tribe, has its Veſſels, which act as Roots, inoculated into the Veſſels of the Stock it grows upon; ſo that when the Sap of one is ſet to work, the Sap in the other muſt neceſſarily be moving at the ſame Time; and, one may ſay, there is a general Circulation of the Juices in the Stock and the Bud of the ſame Sort, as in Animals, where the finer Juices are ſeparated from the Blood, ſuch as Urine, Milk, *&c.* which only change their Colour, Flavour, and Uſe; as the Veſſels, thro' which they paſs, happens to be differently form'd, ſo the Bud, which encloſes the Hereditary Virtue of the Golden-Pippin, will ſtill be the ſame, tho' it receives its Nouriſhment from a harſher Apple, its Parts are made to filter its Nouriſhments in ſuch a Manner, and no other. But when theſe Juices are once receiv'd by the Bud, they cannot be return'd again into the Body of Sap, from whence they were firſt drawn, no more than the finer Juices, in ſome Parts of Animals

mals, can be return'd back into the Blood, but muſt circulate in thoſe Bodies which have receiv'd them; and, without they can diſcharge themſelves ſome Way or other, will occaſion the Parts, which contain them, to ſwell and grow larger, from the continual Addition they receive from the great Body of Juices, which is the Occaſion of a Bud's ſwelling into a Branch, and the Reaſon why a Bud, of any particular Tree, preſerves its original Virtue, tho' it be made to grow upon a different ſort of Tree.

While I am ſpeaking of Buds, I cannot help obſerving, that all Bulbs are improperly call'd Roots; for, in Reality, they are only Buds, which include the Image of the Mother Plant, which they ſpring from Fibers, which they produce when they are put into the Ground, are the Roots which properly nouriſh ſuch Bulbs.

But I am, in the next Place, to ſpeak of the Multiplication of Plants by Seeds, and to account for the Varieties which the Seeds that are gather'd from one Plant will produce.

What I have remark'd in my former Diſcourſe concerning the Generation of Plants, may give us to underſtand, that the *Farina fecundans*, or Male Duſt of a Flower, may be convey'd from one Flower to another, by Means of the Wind; and if the Flower be a Yellow Tulip, for Example, from whence the Male Duſt is blown, and the Flower, which it is blown upon, be a Red Tulip, ſo that the Ovary of the Red Tulip be impregnated with the Duſt of the Yellow Tulip, then the Grain, or Seed, which is ſo impregnated, will produce a Tulip, which ſhall partake of both the Colours, Red and Yellow, and not be ſtrictly like either the Mother-Flower or the Sire: This we find certain from Experience. So if we plant a White Cabbage near a Red one, the Seed of each of them will produce Varieties partaking of both Colours, ſome quarter'd with Red and White, ſome vein'd with Red, *&c.* which I have alſo experienc'd. As likewiſe the ſowing the Seeds of a particular Sort of Fruit, which, by growing among Varieties in a Garden, ſuch Seed has brought almoſt as many Varieties as there were Seeds put into the Ground; ſo that where we have many Varieties of the ſame

Tribe of Flowers, or Fruits, or Herbs, growing in one Garden, the Seed of any one of them will produce Plants, which will be different, in ſomething or other, from the Mother-Plant, they were gather'd from. And this, I ſuppoſe, gave the Ancients Room to believe, that Corn would degenerate in Three or Four Years, becauſe it is almoſt impoſſible to ſow a Buſhel of any Corn, which ſhall be all of one Sort of Grain. Again we obſerve, that when we have a Flower of a ſimple Colour, ſuch as a Black *Auricula*, for Example, and that we keep this Flower remote from others of the ſame Tribe, which are of different Colours, then the Seeds, which we gather from the Black *Auricula* will bring Plants that ſhall only produce Black Flowers. So if we have a Breed of White Cattle, their Offspring will be White, 'till we mix them with Cattle of another Colour, and then we ſhall have a Py'd Breed; but in the Affair of Generation, Nature will, in ſome Caſes, permit of the Production of ſuffering of Plants or Animals to Couple with ſuch as are not directly of the ſame Species. So the Aſs and the Mare produce a Mule; but then to prevent the Increaſe of ſuch monſtrous Productions, Mules, whether Male or Female, are not capable of continuing their Species by Generation. The ſame is the Caſe among Vegetables, as we find in the ſeveral Plants, which have been rais'd from ſuch Carnation-Seeds, which have happen'd to be impregnated by the Farina of the Flower call'd the Carnation and Sweet-William but the Seeds of ſuch Plants, tho' theſe will ſometimes ſeem perfect, yet will not grow no more than a Male and Female Mule can produce any Offspring, tho' no Creatures are more addicted to Venery.

There ſeems to be the ſame Difference, in Nature, between the Carnation and Sweet-William, which produce a Third Sort of Plant, as there is between the Horſe and the Aſs, which produce the Mule.

From hence we may learn, that when we have a Mind to preſerve any particular Quality in a Plant that we deſign to increaſe by Seed, we ſhould never ſuffer any Plant to grow near the Plant we propoſe to ſave the Seed from, which may have Power of debaſing or adulterating the Seed, and then we may expect ſuch Seed to be good, or to inherit the Virtues and Qualities of the Mother-Plant; which is a very neceſſary Obſervation in the ſaving of the Seeds of Annual Plants, becauſe there is no other Way of raiſing Annual Plants, but by Seeds.

On the other Hand, if we have a Mind to produce Variety by Seed, ſuch as one would wiſh for in the Production of Flowers, our Hopes will depend upon the Number of different colour'd Flowers of the ſame Tribe which are growing together, for then there will be an Opportunity of the Farina, or Male-Duſt, of one Sort, to impregnate the Egg, or Seed-neſt, of another: And it would be well worth our Care to make our Experiments with that Exactneſs, that one may come to know what Properties are preſerv'd of the Mother, and what of the Sire, whether thoſe of the Male, or of the Female, are predominant. There are yet many particular Obſervations relating to the Generation of Plants, which I have mention'd in my printed Works of Husbandry and Gardening, which may be conſider'd; but I judge, that the Inſtances I have here produc'd may be ſufficient to render that Syſtem intelligable.

It remains now, that I ſpeak of the Seed of a Plant, and what ought principally to be obſerv'd in its Management.

All Seeds whatever, which have been perfectly impregnated, contain the Image of the Plant in Miniature, from whence they ſpring. This Image is the Conſequence of the Impregnation, which is abſolutely neceſſary for the Multiplication of the Species in Plants; as the Cock's Tread is neceſſary in the Egg, to render it prolifick by Incubation. The Incubation of Birds, or Fowls, is Analogus to the Burying the Seed of Plants in the Earth, that it may hatch into a Plant: The Oſtrich, as a Fowl, and the Tortoiſe, and many other Creatures beſides, which are Oviparous, take the ſame Way of Hatching their Young; that is, they bury their Eggs in the Sand or Earth, where they happen to be when they lay their Eggs.

In all Seeds or Eggs, we find ſuch Parts as are proper to nouriſh the little Plant 'till it can ſhift for itſelf, and draw its Nouriſhment from the Earth; ſuch Parts are the Lobes, or Ear-

Leaves, which join with the young Plant and incloſe it: They are Spongious or Fungous Bodies, which, by gentle Degrees, receive Nouriſhment from the Juices of the Earth, and after they have filter'd, and alter'd them, according to the different Textures they may happen to be of, the little Plant, which is lodg'd within them, receives its firſt Nouriſhment from them, and their Juices begin to circulate in the little Plant they contain; 'till, at length, the Radicle becoming, by Degrees, more acquainted with the Diet it can receive from the Earth, begins to ſhift for itſelf, without feeding any longer from the Lobes or Ear-Leaves, from whence it firſt receiv'd its Support; and then, as conſtantly the Ear-Leaves fall from the Plant, as they are then of no further Uſe to it. I might add, that all Seeds are cover'd with Coats, which are finely and cloſely wrought, the better to keep the Moiſture of the Earth from coming too ſuddenly upon the Lobes, or the little Plant, which might occaſion their rotting; and we find, that almoſt every Sort of Seed, by Means of theſe Coverings, muſt paſs different Lengths of Time in the Earth, before they begin to Germinate: Some will not ſpring in the Ground 'till the Second Year after they are bury'd, while others will begin to ſhoot in Three Days after ſowing.

This being conſider'd, we are next to obſerve, that Seeds, as they are of different Textures, of different Modes, and of different Sizes, they require to be ſown in different Depths of Earth; and, conſidering their Tenderneſs at their firſt ſprouting, it is alſo neceſſary to prepare the Earth very fine and light where we ſow any Seed; but the moſt robuſt Seeds may be ſown in the heavier Land. The Seeds which are the longeſt coming up, ſuch, I mean, as will lie without Motion a Year in the Ground, may be ſown full Two Inches deep in light Soil, or of a proportionable Depth, as the Soil is heavier; and the ſmaller and lighter the Seed is, ſo it muſt be ſown ſhallower, and in lighter Earth, than other Seed. We are forc'd, in ſome Caſes, to ſow the very lighteſt of Seeds in rotted Earth of Willows, or other light Woods, and then only to rake that Earth finely, ſo that it may lie looſe, and ſowing them upon the Surface, preſs it down, or flat it, with a ſmooth Board. This is the Method of ſowing Auricala Seeds, and the Seeds of Ranunculus, are not to be cover'd much deeper.

From theſe Obſervations, we may know how to regulate any Seminary; either if we have a Mind to preſerve the particular Virtues in any Annual Plant or Flower, or to produce Varieties, or to raiſe any Plant from Seed, with good Succeſs.

I ſhall conclude with remarking, that what we call Corn, or Grain, is not properly a Seed, becauſe no Sort of Corn brings Ear-Leaves, but ſprouts directly with a Leaf at its firſt Germination; which Leaf, Dr. *Grew*, in his *Anatomy of Plants*, calls an *Acroſpire*. This is like what we call, commonly, a Bulb, which is, properly, a Bud; as I have accounted for in this Diſcourſe.

DISCOURSE VI.

Of the different Ways of propagating of PLANTS, by SEEDS, CUTTINGS, &c.

THE Contents of this Diſcourſe, as they relate to the different Ways of propagating of Plants, ſo are they depending upon the former Chapters, which treat of the Anatomy of Plants, and of the Motion of Juices in Plants; to which we muſt have a ſtrict Regard in the Practice of every Leſſon I ſhall here ſet down.

I ſhall begin with increaſing of Plants by Cuttings: By a Cutting, I mean a young tender Twig, of the laſt Growth, to be cut from a Plant, in order to make it ſtrike Root, by burying Part of it in the Earth, by which Way many Sorts of Plants may be increas'd; eſpecially thoſe whoſe Shoots are the moſt Juicy, or Succulent, or contain the moſt watry Juices: For, as I have obſerv'd before, ſuch Plants as are fill'd with Gummy or Rozinous Sap, will rarely take Root from a Cutting.

When we find ſuch as are for our Turn, we muſt cut them from the Mother-Plant, either in the Spring, juſt as the Sap is beginning to move in them, or elſe about Midſummer, when they have juſt finiſh'd their firſt Shoot; always obſerving that they are tender. For an Example, we ſhall propoſe the Myrtle, whoſe Cuttings, at theſe Seaſons, are tender, and little inclining to be Woody. The Cuttings of this Sort may be about Four Inches long, becauſe there will be as many Buds in that Length of a Myrtle-Shoot, as one may find in a Shoot of a Vine, and other ſuch like Plants of a Yard long; and the more

Buds we bury, ſo the more Roots we ſhall have, and the greater Number of Roots will gather a greater Quantity of Nouriſhment; and, conſequently, the Buds above Ground will be better fed, and be more vigorous in their Growth. The Myrtle Cuttings will preſently ſtrike Root, if the Earth we plant them in be made very fine, and well clos'd about them, both by the Hand and by watering; but it muſt be obſerv'd, that the Leaves muſt be taken off with a Knife carefully, from that Part of the Cutting which is to be bury'd in the Ground, which, in a Myrtle Cutting of Four Inches long, ſhould be near Three Inches, that we may leave little more than an Inch above the Surface of the Earth.

In planting of Vine-Cuttings, I prefer the *French* Way before the common Method practis'd by our *Engliſh* Gardeners. The *French* never plant Vine-Cuttings leſs than a Yard in Length, and then leave only Two or Three Buds out of the Ground, ſo that the firſt Shoots are always ſtrong. Their Way is to open a Trench about *October*, and ſet their Cuttings in it about a Foot diſtant from one another, and then fill in the Earth, and tread it down hard; of theſe Cuttings, perhaps Nine or Ten Buds of each may only be bury'd for making Roots; but in *England*, our Vine-Cuttings are ſeldom longer than a Foot, and, perhaps, not above Two or Three Buds of each are cover'd with the Earth; ſo that the firſt Shoots are weak, and will require ſeveral Years to gain Strength enough for bearing.

In making Cuttings alſo of Jeſſamin, and the Honyſuckle, whoſe Wood is tough and hard, it is the common Practice to let their Leaves drop before we prepare them for Planting. In theſe the Buds ſtand wide aſunder, and therefore their Cuttings ſhould be of ſuch a Length, that we may bury them a Foot in the Ground, at the leaſt: But I find, that if we plant our Cuttings in the Summer, as ſoon as they have finiſh'd the firſt Shoot, they will anſwer our End much better; but then they muſt be well follow'd with Water, and be ſet in a ſhady Place: Or, to ſave that Trouble, we may open a Trench, and fill it with freſh Cow-dung, and, upon that lay Three or Four Inches of good ſifted Mould; in this prepar'd Bed our Cuttings will proſper exceedingly, for the Cow-dung will keep them conſtantly moiſt, and keep the Air from them, and nouriſh them. It is alſo to be obſerv'd, that all hardy Ever-greens will do beſt from Cuttings, if we plant them about *October* or *November*, for then their Juices are in Motion. Again, we muſt remark, that when we collect Cuttings of thoſe Plants which are very ſucculent, ſuch as the ſeveral Sorts of Cereus, Ficoides, Sedums, *Indian* Figs, and ſuch like, we muſt, in Proportion to the Succulency of ſuch Cuttings, let them lie ſome Days expos'd to the Sun before we plant them, that the wounded Parts may be throughly dry, for otherwiſe, their own Moiſture mixing with the Moiſture of the Earth, would rot them. The Time of making Cuttings of theſe is always when we find them inclinable to grow, which is at different Seaſons, as the natural Springs of their ſeveral native Countries happen to fall out; for Plants of every Country in the World will always preſerve their natural Time of ſhooting, wherever they happen to be ſtation'd. The great Point to be conſider'd in planting of Cuttings is, that we keep the Air from drying the Parts under Ground as much as poſſible; and, in ſuch as are very ſucculent, to plant them rather upon the natural Earth than in Pots, for from the whole Body of Earth there will exhale continually a

Vapour gently moiſt, which will diſpoſe them for drawing Root; but in Pots we muſt be oblig'd to water them frequently, which often occaſions them to rot, and if we give them too little Water, then the Earth in the Pot will become ſo dry at particular Times, that the Cutting will be put aſide from the drawing of Roots, tho' by the Moiſture it had at other Times, it was diſpos'd to make Roots: For, according to the following Experiment, it is a continued gentle Diſtribution of Moiſture to a Cutting, which will occaſion it to ſtrike Root, and when it is once in that Method, if we ſuffer it to dry, the Intent of making Roots is ſtopt. The Experiment I mean is, that if we take a Branch of the Sedum Arboreſcens, or Tree Houſleek, and hang it up in the Houſe, we ſhall ſee it put out Roots when the Air comes to be of a certain Denſity or Thickneſs, and as ſoon as the Air becomes dry, and more rarified, theſe Roots grow dry, and ſhrink away; but if we keep this Plant in ſome Place where the Air is continually moiſt, the Roots will be conſtantly growing as long as there is any Moiſture in the Plant; but the Head, or Top Bud of the Plant, will not grow at all, for that the Roots cannot draw Nouriſhment enough from the Air to feed it. What I have remark'd concerning the planting of Cuttings of Ficoides, Geraniums, Cæreas, *Indian* Figs, Aloes, and ſuch like, in the natural Ground, I have experienc'd to be much the beſt Way; they will ſoon draw Root, and make good Plants, ſo that we may Pot them about the Middle of *Auguſt* of the ſame Summer, in order for the Green-houſe.

The Directions I have given for the raiſing of Plants by Cuttings, may, in a great Meaſure, ſerve for the raiſing of Plants by Layers; that is, we muſt take Care to bury Buds enough in the Ground when we make Layers, provided they are ſuch as are found upon a tender Shoot of the laſt Growth; but the old Wood of ſuch Plants, whoſe Subſtance is hard, ſuch as Oak, and the like, will not make Roots, tho' we lay them many Years in the Ground. The Seaſon when we commonly make our Layers of Trees is in *September*, *October*, or *November*, becauſe they may have Time enough to be acquainted with the Earth, before the Spring comes on; that is, that their Gummy or Rozinous Juices may be, by Degrees, impregnated with the watry Parts of the Earth, and, by that Means, facilitate their

Change. It is a Practice among the Nurſery-men, to cut off the Heads of ſuch Trees as they deſign to increaſe by Layers, in order to make them produce young Shoots near the Ground, that they may be bury'd more eaſily in the Earth. Theſe Mother-Plants they call *Stoles*; ſignifying a Shoot or Twig of a Tree ſpringing from an old Stock; ſuch as, by ſome of the Ancients, was call'd an *uprofitable Branch*, becauſe it brought no Fruit, and ſo, corruptly, the Gardiners uſe the Word *Stolo*, for the old Stock which produces ſuch Branches: But whatever Layers we make from ſuch Twigs, muſt, when they are bent to the Ground, be carefully pinn'd down with hook'd Sticks, that when we have once fix'd them, they may not ſpring or ſtart from their Places. In making of Layers to be taken from the Stocks, and tranſplanted without loſing of Time, I have practis'd the drawing Shoots of Plants thro' the Holes at the Bottoms of Garden-Pots, and then filling the Pots with Earth, they will take Root in the Pots: But in the drawing ſuch Shoots thro' the Holes of the Pots, we muſt take Care, that we do not break off the Buds from the Shoots. Theſe Layers, when they have taken Root in the Pots, may be taken from the Mother-Tree, and, with all their Earth, be turn'd out of the Pots, and ſet directly in a Place for bearing. Some Sorts, as Vines, for Example, will ſtrike Root in Five or Six Months: We may lay them in *November* or *December*, and we may cut them from the Vine when their Grapes are ripe; but ſome Sorts of Plants require to be bury'd 'till the ſecond Year before they take Root: And, indeed, Vines may be cut from the Mother-Plant much ſooner, but then their Fruit will not be perfectly good, as if we let them feed from the old Stock, 'till their Fruit is ripe, and then we may bring the whole Plant, with its Fruit, upon the Table, before we plant it in the natural Ground. I cannot well paſs by an extraordinary Obſervation of Dr. *Agricola's*, a Phyſician of *Ratisbone*, who was curious in this Way, relating to the raiſing of Plants from Cuttings, that our firſt Regard ought to be how to preſerve them from ſhrinking by the Air; and he even propoſes to plant Cuttings, and make Layers of Plants while they are ſhooting, and are in the moſt tender State; for which End, he preſcribes ſeveral Preparations of Gums, to dip that End of the Cutting in, which is to be bury'd in the Ground; which, by Experience, I find, will nouriſh the Cutting, will preſerve it from rotting, and keep it from ſhrinking by the Air. This I have try'd, as alſo to plaiſter the Cuttings with Soap, and have found them both ſucceſsful even in the Cuttings of Peach-Trees, Plumbs, Vines, and ſeveral Ever-greens in Summer. The Compoſitions of Gums, I ſhall mention in another Diſcourſe.

There is alſo a Method of encreaſing of Plants by the Leaves, but then they muſt be ſuch as are ever-green, like thoſe of the Holly, Bay, Orange, Lemmon, *&c.* which being taken from the Plants when they are fully perfected, without any Buds adhering to them, and then immediately dip'd in a Mixture of Gums, as I ſhall relate hereafter, while the Mixture is Blood-warm, and put into the Earth as deep as the Compoſition of Gums has cover'd them, which may be about an Inch, the Earth muſt be preſs'd cloſe about them, and very well water'd. This I have ſeen practis'd, and will bring us very fruitful Plants, for out of the extreme Parts of the Foot-ſtalks of the Leaves, will ſprout a Bud that will bring Bloſſoms and Fruit, if the Leaves are taken from ſuch

Places where the Buds adjoining to them has produc'd Bloſſoms. This is one Reaſon why, I ſay, that a Leaf is a perfect Plant, which grows upon another Plant.

As to what regards the raiſing of Plants from the Fruit, concerns only the *Indian* Fig, whoſe Fruit, while it is green, being ſeparated from the Mother-Plant, and ſet in the Earth, will grow, as I have experienc'd; that is, after we have given it Time to dry in the Sun, it will produce a Plant as perfect as that we took it from: But it is to be obſerv'd, that the Fruit of the *Indian* Fig is always in its full Growth before the Bloſſom is open; and yet this muſt not be taken as an Inſtance to contradict the Syſtem of the Generation of Plants, becauſe this is yet green, and the Seeds in it are imperfect, ſo that it has the ſame Liberty of acting in the Ground as any other Part of a Plant. And it is alſo obſervable, that theſe Sort of Fruit, in our Climate, with the Shelter of a Green-houſe, will not change its Colour towards Ripening, 'till the Summer after the Bloſſom: And it is alſo obſervable, that this Sort of Fruit, in Summer, is beſet with Buds on every Side.

It next follows, that I mention the Manner of increaſing Plants by their Roots, which is the laſt Way we have Recourſe to, when we are not provided with the Seeds of a Plant. This is done by ſevering, or cutting ſome of the larger Roots, near the Surface, from the Tree, and without diſturbing any of the Fibres which belong to ſuch Roots, to raiſe the wounded End of the Root gently, 'till we can bring Part of it above Ground to ſtand upright, the more of it the better. This, by being expos'd to the Air, will, in Proceſs of Time, be diſpos'd to put forth Buds for Leaves and Shoots, and make a Plant, which may afterwards be remov'd; but ſome Plants are ſo ſtubborn, that after a Year or Two, ſuch Roots will not ſhew any Buds, tho' we may find them then alive. When this happens, we may graft a Cion from the Head of the Tree upon the Root thus prepar'd, and we ſhall preſently have a Plant for our Purpoſe: Or we may graft upon ſuch Roots about Six Months after they have been diſciplin'd after the Manner above directed. Thus have I gone thro' the Methods of increaſing of Plants by Cuttings, by Layers, Leaves, Fruit, and Roots: It remains that I ſhould ſay ſomething concerning the increaſing of Plants by Off-Sets; but as that Way of Multiplication relates chiefly to the Improvement of Flowers, ſo I ſhall rather leave it for that Diſcourſe.

I ſhall therefore proceed to explain the ſeveral Ways of Grafting, by which Trees are improv'd from Wildings to bring good Fruit: In order for which Deſign, our Garden ought to be ſtor'd with Stocks of all Sorts; that is, with ſuch as are Pomiferous, or Apple-bearing; Pruniferous, or Plumb-bearing; Bacciferous, or Berry-bearing; Coniferous, or Cone-bearing; Nuciferous, or Nut-bearing; Glandiferous, or Maſt-bearing; and Siliquiferous, or Cod-bearing; becauſe we may ſometimes meet with a ſtrange Tree, which will only be encreaſed by Grafting: And as all Trees, that I can now think on, are of one or other of theſe Claſſes, ſo our Nurſeries ſhould be provided with Stocks of theſe ſeveral Sorts, that we may graft the Apple-bearing upon the Apple-bearing, the Pruniferous upon the Pruniferous, and ſo on.

The Wilding which we are to graft upon, we call the Stock, and the Twig or Shoot which we are to graft upon the Stock, is call'd the Cion, or Graft: Every Cion, or Graft, when it is rightly diſpos'd on the Stock, according to Art, will take Root in the Stock, and retain the Virtues of its Mother-Plant, as I have obſerv'd before.

Some Sort of Plants will more readily join by Eneying or Inoculating, than by Grafting; and there are others which will not take by either of thoſe Ways, but by Inarching only: Again, there are ſome which will only join by approaching, all which we ſhall conſider in their Order; obſerving, by the Way, that Nature gives us large Liberties in Grafting, ſuch as that we may graft Apples upon Pears, or Pears upon Apples, and both theſe upon the common White-thorn; upon which, likewiſe, we may graft Medlers, the Lazeroli, and Cervices, and upon the Pear-Grafts we may alſo graft the Quince: All theſe may be made to grow upon one Tree, by Whip-grafting, or by Cleft-Grafting, or Stock-grafting, or by Inoculation, Eneying, or Budding.

So the Pruniferous Fruits, ſuch as Peaches, Nectarines, Apricocks, Cherries of all Sorts, and Plumbs of all Sorts, may be budded upon Plumbs, or upon one another: And what ſeems extraordinary, is, that the *Lauro Ceraſus*, which is our common Laurel and Ever-green, may be inoculated upon the Cherry and the Plumb, and be made a Companion for all thoſe of the Pruniferous Race. An Inſtance of this Sort is now in the Garden of Mr. *Whitmill*, a curious Gardiner of *Hoxton:* By this we may obſerve, that theſe Grafts, or Buds, are ſo many Plants of different Kinds, which grow upon one Plant; which is like one certain Sort of Soil, wherein we find growing many Plants of different Sorts; but we muſt obſerve, that one Kind will proſper better than another.

The firſt Sort of Grafting, which I ſhall mention, is that Sort which we call Whip-grafting, or Rind-grafting: This is perform'd by paring off Part of the Bark on one Side of the Stock, either after we have cut off the Head of the Stock, or elſe while the Head remains on the Stock; for it is done both Ways. If we cut off the Head of the Stock, then the Bark we take off muſt leave the Wood bare, about an Inch and half from the Place where the Head is cut off downwards towards the Root, and as wide as the Cion, which we deſign to join with it; then we muſt, with our Knife, ſlit the Stock down from a little below the Place where the Head is cut off, guiding it with the Grain of the Wood, 'till we have made a Tongue on the Side of the Stock where the Bark is par'd off, about an Inch long. This being done, we are next to pare off the Bark from one Side of the Cion, and then, with our Knife, make a Tongue in the Wood of the Cion, of ſuch a Length as may fit exactly with that in the Stock, which when we have join'd together, ſo that the Barks of both the Cion and Stock join together, we muſt tye them faſt with Baſs, and cover all the wounded Part with fine Loam, well mix'd with Cow-dung or elſe we may cover the wounded Part with the following Mixture, *viz.* to Four Ounces of Bees-Wax add as much Tallow, and when theſe are melted together, add about an Ounce and half of Roſin, which muſt be uſed when 'tis Blood-warm, with a ſoft Bruſh, and then we need not tye the Cion and the Stock together; for theſe Coverings are only deſign'd to keep the Air and the Wet from the wounded Parts, 'till they join together, which they will ſoon do, if the Tongues of the

Stock and the Cion are well wedg'd into one another. When we uſe this Sort of Grafting, without cutting off the Head of the Stock, we then take the Bark from the Stock in any ſmooth Part of a Shoot, *i. e.* between the Buds, and fitting the Cion to it, as before with Tongues, we then cover the wounded Parts with ſome of the aforemention'd Grafting-Wax. This laſt Operation may be done when the Sap is in its higheſt Fluences; but the firſt muſt be done juſt before the Buds begin to ſhoot.

Cleft-grafting, or Stock-Grafting, is perform'd by cutting off the Head of the Stock, and then, with the Knife, ſlitting the Stock downwards an Inch or two, in Proportion to the bigneſs of it, and of the Cion we are to put into it. We then cut the Bottom Part of the Cion Wedge-ways, of the ſame Length we have made the Slit, and ſo place the Cion in the opening we have made in the Stock, that the Bark of the Stock and the Cion both join, or match with one another.

If the Stock happens to be very large, as ſometimes it is, when we uſe this Kind of Grafting; ſuch as an old Tree ſaw'd off, which may, perhaps, meaſure Three Foot in the Girt, then we muſt be forc'd to open the Places, where we are to fix our Grafts, with Chizzels, and keep them ſo open with Wedges, 'till the Grafts are fix'd to our Mind. In ſuch Stocks we may place Three or Four Grafts, but Two are enough, if we could be ſure they all would take: In this Caſe our Cions may be larger than if the Stocks were ſmall. In *Worceſterſhire*, it is common enough to graft Apples this Way, with Cions, which meaſure about Five Inches in the Girt, and they proſper very well: But we muſt obſerve, that our Cions may be larger, if they are of Trees that have tender Wood, than if they are of a hard Wood; when this is done, lay on ſome of the Grafting-Wax, as before directed, ſo as to cover all the wounded Parts of the Stock and Cion. In this Caſe, where the Stock is large, there is Vegetable Matter enough in it to feed the Cions to good Advantage, ſo that the Third Year they will produce extraordinary large Fruit, tho' before the old Head was cut from it, the Fruit was hardly bigger than Hazle-Nuts. Here is another Example of a Tree's growing upon a Tree; and as the Clift-grafting is practicable upon the oldeſt Trees, ſo is it to be done upon

Plants which are not above Three Months old from the Seed. This I learnt from Mr. *Curtis* of *Putney*, a very curious Gentleman in the Knowledge of Plants: His Method is, when he raiſes Orange-Trees from Seeds, that as ſoon as he finds they have got a Stalk about Three Quarters of an Inch above the Ear-Leaves, he cuts off the Top, and making an Inciſion croſs that Stalk, bears his Knife downwards, towards the Part where the Ear-Leaves join with it, and then chooſing a tender Shoot of a bearing Tree, that will match with the Stock, he cuts the Bottom of it in the Manner of a Wedge, and places it as I have related before, ſo that the Barks may join, and then applies ſome of the Grafting-wax warm with a fine Painting-Bruſh. This Operation may be done all the Summer long, and is particularly explain'd in my Philoſophical Account of the Works of Nature.

I am next to ſpeak of Inarching, that is Inlaying the young Shoots of one Tree into another; which is the ſureſt Way of Grafting that I have yet mention'd; for here, if the Part which acts as a Cion does not happen to join with the Stock, it may ſtill remain upon the Tree. To perform this Work, one muſt have a Collection of Stocks in Pots, that when we have any particular Tree which we have a Mind to encreaſe, we may bring the Stock to it, and then cutting off the Head of the Stock, we chooſe out ſuch a Shoot of the valuable Tree, as may, with the moſt Eaſe, be brought down to the Stock, and then we muſt order both of theſe with Tongues, as I have directed in the Whip-Grafting, only we muſt leave that Part which is to act as a Cion to join with the Tree in ſuch a Manner, that it may be well fed with the Juices of the Tree. I commonly, in theſe Caſes, cut the Tongue of the Graft half way only thro' the Shoot: This being thus order'd, we are to tye our Two joining Parts very cloſe, and then cover them with the Mixture of Loam and Cow-dung, alſo taking eſpecial Care to ſecure the inlay'd Branch from flying from the Stock, which ſometimes it will be apt to do, if it is not well ſecur'd by Strings or Sticks; for tho' this is not a Work to be done in the Summer, when the Plants have their Sap in the greateſt Fluency, yet the mildeſt Summer is not without its Storms, eſpecially in *June* or *July*. It is to be noted, that ſome Plants ſhould remain thus join'd 'till the ſecond Year, before we cut them from the Bearing, or the deſir'd Plant; eſpecially thoſe whoſe inarch'd Shoots are of a more hard or Woody Nature: But where we can inarch green Shoots, ſuch as thoſe of Oranges or Lemmons, if we do this Work in *May*, we may cut them off in *Auguſt*, if we find they have taken hold of the Stocks.

When we have cut our Plants from the Mother-Tree, ſet them immediately in ſome Place of Shelter, where the Winds may not get at them, for elſe the new Heads, which are tenderly join'd, will be ſubject to break from the Stocks; or if the Stock be growing in the natural Ground, then when we cut the young Inarch from the Tree, we muſt be careful to guard them well with Stakes.

Inoculation is the next Improvement I ſhall treat of. To Inoculate is the ſame as to Eneye, or to Bud; and is nearly the ſame as the Ancients call'd Emplaſteration; only their Emplaſteration was cutting out a large Piece of the ſmooth Bark of a Tree, with ſeveral Buds upon it, and then opening the Bark of another Tree in ſuch Manner as to lay the Bark of the bearing Tree cloſe to the Wood of the Stock; they then cover'd the wounded Parts over with a kind of Mortar, or prepar'd Loam. This Method is ſafer and ſurer in the way of Inoculation, than our inoculating with a ſingle Bud, becauſe the great Quantity of Bark taken off with the Buds, which may be about Two Inches ſquare, muſt hold a good Fund of Nouriſhment to ſupport the Buds 'till they have join'd with the Stock: But, however, our common Way of inoculating with a ſingle Bud is not inferior to moſt of the modern Ways of Grafting, provided we take Care to be guided by the Vigour of the Sap: I mean, that we never attempt to Bud or Inoculate any Tree, but when the Bark will riſe freely from the Wood, as the Gardeners ſay; or, in other Terms, will ſlip from the Wood.

Our Buds, in this Caſe, muſt be ſuch as can be taken from the laſt perfect Shoot of a Tree, and of the Bark in which this Bud happens to be plac'd about half an Inch below the Bud, and as much above it, and on each Side the Bud about half an Inch; then making the Inciſion in the Bark of our Stock, like the Letter T, we raiſe that Bark on both Sides from the Wood, and then ſtripping the Bud from the Woody Parts which join to it, inſert it between the Bark and the Wood of the Stock, and tye it with Baſs, ſo that the Bud may not be hurt or cover'd; or elſe ſome of the Grafting-wax, being apply'd as directed in the former Graftings, will be ſufficient without tying.

I have now only to preſcribe the Method of approaching, or Grafting by Approach, which ſome have falſly taken for Inarching. The Ancients, in moſt of their Works, recommend it as the ſureſt Way, and I have had Experience enough to find it as they ſay: I have mention'd it in my Monthly Writings, but I know no Gardener that has it in Practice, at preſent, but Mr. *Whitmill* of *Hoxton*. It is perform'd in young Shoots, while the Sap is fluent, or in Shoots of the laſt Growth, when the Sap is beginning to flow vigorouſly; we then place Two Plants together, and paring off the Bark from one Side of a Branch of each of them, we apply the wounded Parts to one another, and tye them together with Baſs; and if they are tender ſhooting Plants, they will ſoon unite in their Woods, and may be cut off in Three or Four Months: And when Plants are very different in their Nature, as the Fig and the Mulberry, or the Vine and the Paſſion-Tree, we may reconcile them by this Means, as may be obſerv'd in the Garden above-mention'd, As for the Method uſed by the Ancients, of Ferebration, or bowing of Trees, it was no more than piercing thro' the Bark, and then preſſing the Inſtrument downwards, between the Wood and the Bark, they made Room enough to receive the Foot of the Cion Two or Three Inches, by which Way the Cion was fed, and ſtruck Root in the Tree; but the Foot, or Bottom Part of the Cion, muſt be prun'd a little, ſo as to make it terminate in a Point, and when it is fix'd we muſt cloſe the Orifice with Grafting-wax. This is now out of Practice among the Gardeners, but I find it of good Uſe, eſpecially in difficult Caſes: The Time I have try'd it with Succeſs, was when the Bark would ſlip eaſily.

Thus I have gone thro' the Buſineſs I propos'd in this Diſcourſe, and I ſhall conclude with obſerving, that a curious Man, in this Way, may employ himſelf every Month in the Year, either in the Experiment of encreaſing Plants by Cuttings, Layers, *&c.* or in improving them by Grafting, *&c.* I mean, if the Winter is not too ſevere to ſhut him out of the Earth.

DISCOURSE VII.

The Manner of making PLANTATIONS, either for Pleaſure or Profit.

IN a former Diſcourſe, I have hinted at ſeveral neceſſary Conſiderations, when we are to make Plantations of Trees, *viz.* that the beſt Seaſon to remove or tranſplant Trees is in the Summer, while they may have an immediate Opportunity of ſtriking Root. In the next

Place, that it is improper to cut off the Head of a Tree when we plant it, becauſe the Juices while the Head is on, have a greater Power of acting upon, and aſſiſting the wounded Root; for while the Branches are on the Tree, the Circulation is better maintain'd than when they are taken off, for the Branches will imbibe a Moiſture from the Air and Dews, and while the Branches and Leaves I mention can have the leaſt Share of Action, the whole Body, upon which they depend, muſt be in Action to fix the Earth cloſe about the Roots of a Tree, when we tranſplant it, and let as little Air as poſſible come at the Root in the removing it from one Place to another, for the Air dries and ſhrinks the Roots, ſo that they are a long Time before they can recover. I have alſo touch'd upon the Neceſſity of plaiſtering the Wounds of the great Roots, if any of them have been cut, with Mixtures of Gums, ſo that the Air and the Wet may be kept from having any Communication with the Sap-Veſſels, which would either ſhrink them or rot them: Beſides, when theſe Veſſels are ſtopt, the Juices in the Body of the Tree are more capable of performing their Circulation regularly, and of diſpenſing their Nouriſhment to thoſe

Buds which are to act as Roots, which, with the Cautions abovemention'd, will do their Duty immediately, as they are already acquainted with their Office, while the Buds of Cuttings, or Layers from Trees, which had already been prepar'd for acting above Ground, would be tedious in reconciling themſelves to the Change of making Roots.

But it is neceſſary, that I lay down ſome general Rules for the preparing of the Mixtures of Gums to be uſed as Plaiſters to the Wounds of Trees, that they may ſerve to nouriſh the Plants as well as heal their Wounds. I have already mention'd the Benefit which Cuttings, and even Leaves of Plants receive from Mixtures of Gums in general; but to be particular, one may reaſonably ſuppoſe, that ſuch Gums as comes neareſt to the Juice of any Plant we are to uſe them to, will be more helpful to ſuch a Plant than Gums which are of a different Nature. Let us then conſider, we have Pitch, Rozin, Turpentine, Gums of Plumbs, Cherries, *&c.* to which one may add Bees-wax, which is gather'd from the finer Parts of Flowers, without Diſtinction, which is alſo a Sort of Gum. From theſe, one may, I ſuppoſe, prepare ſuch Compoſitions as might agree with the Temper of any Plant, eſpecially if we take in to our Aſſiſtance any Juices or Infuſion, Decoction or Digeſtion of Animal Parts, ſuch as Tallow, or ſuch as may be incorporated with Gums.

So, for Example, if we are to prepare a Mixture for Firs, Pines, Pinaſters, and ſuch like Turpentine, may have the greater Share in the Preparation; but with this we may put Bees-wax, and a ſmall Share of Tallow, in ſuch Quantities, as that the Tenacity of the Turpentine may not be loſt; but if we ſhall happen by Accident to have put too much Tallow, we may then have Recourſe to Roſin, which, in a ſmall Quantity, will bind the Parts of the Mixture.

In preparing ſuch Mixtures, we muſt provide a clean Pipkin, well glaz'd, into which we ſhould firſt put our ſofteſt Ingredients, and by Degrees as they melt, break in the others, keeping them all ſtirring together, 'till they are incorporated as much as poſſible. We muſt alſo, while this Mixture is gently ſimmering, ſet it on Fire, to let it burn Two or Three Minutes: This Burning will help to mix the Parts of the Mixture, and to conſume the more Earthy or heavy Parts. We put out this Flame by covering the Pipkin with a Trencher, and we may renew it Four or Five Times; but as the making of this Preparation is ſomewhat dangerous in a Houſe, it is beſt to be done Abroad, where we may make it with Safety.

In the preparing of Mixtures for Trees of other Kinds, we may uſe the Aſhes of them infuſ'd in Oil, and then mixing a ſmall Quantity of the Oil with Bees-wax, ſome Turpentine, and a Proportion of Roſin, to bind the Parts, we ſhall have a Mixture to our Mind: Or for groſſer Plants, ſuch as Elms, and ſuch like, I have uſed Pitch inſtead of Turpentine with good Succeſs; for I find both Turpentine and Pitch are good general Gums for almoſt any Plants; but Turpentine, eſpecially, is helpful to any Plant, as well as its own; and Bees-wax ought to be in every Mixture of this Kind, for the Reaſon beforemention'd.

When we uſe theſe Preparations, let them be melted, and when they are Blood-warm, apply them with a Bruſh to the wounded Parts, either of the great Roots or Branches, after we have ſmooth'd them well with a ſharp Knife. This Operation ſhould not be neglected a Minute, if poſſible, after any great Part of a Tree is cut off.

In the next Place, I come to ſpeak of the tranſplanting large Trees in Summer, which advantageous Diſcovery is owing to Mr. Secretary *Johnſtoun* at *Twittenham*, which Gentleman now has many Experiments of this Kind in his Garden, *viz.* of Trees of various Kinds planted in *May*, in *June*, in *July*, and in *Auguſt*, which proſper as well as if they had not been remov'd, altho' they were very large at the Time of tranſplanting. The Method is, to open the Trenches, or dig the Holes of a convenient bigneſs, to receive as much Root of the Trees as poſſible, and then to prepare a large Quantity of Earth well skreen'd, and made as fine as may be. We then ſet about our Work in taking up the Trees with as many Roots as we can preſerve, plaiſtering the great Wounds as they happen to be made: This freeing the Roots from the Ground ſhould be done as expeditiouſly as poſſible,

ble, that the ſmaller Fibres may not dry, and then clearing the Roots from all the great Clots of Earth, convey it to the Pit or Trench where it is to be replanted; firſt having furniſh'd the Bottom of the Hole or Trench with a thin Mud made of the fine ſkreen'd Earth and Water, which muſt be kept ſtirring 'till the Root of the Tree is ſet in it, and then immediately pour into the Hole or Trench as much Mud of the ſame Sort as will fill up the Hole or Trench, which Mud muſt be ready prepar'd in large Tubs, and kept ſtirring 'till we uſe it: We muſt then, by ſmall Parcels, ſprinkle ſome of the fine ſkreen'd Mould upon the Mud, daſhing it every now and then with Water, to ſettle it, and ſo continue this Work 'till the Mud in the Trench is well thicken'd. Our Trees, thus planted, muſt be well ſecur'd with Stakes, as thoſe planted at other Seaſons, and when this is done, throw on ſome of the ſkreen'd or ſifted Mould over the Surface, to prevent the Muddy Part from cracking, and letting in the Air to any of the Roots, which it will be apt to do in a Day's Time, as the Moiſture of the Mud ſinks away.

The ſecond Day after planting, we ſhould carefully ſtir the Surface as well an Inch deep of the ſettled Mud, as the other dry Mould upon it, and daſh the whole well with Water, to fill the Cracks, if there are any; and we may depend upon the Welfare of the Plant: But we muſt be ſure to obſerve what I have ſaid before, concerning the planting in Clay Grounds; we muſt not dig into the Clay, but raiſe the Surface. A Tree thus order'd may be prun'd, or have ſome of its Boughs thin'd, Three Weeks after planting. I ſwe did that Work at Midſummer, which is the beſt Time of planting, we muſt obſerve alſo, that after the ſecond Day's Work is over, of ſtirring the Surface of the new planted Ground, we muſt lay ſome Fern, or ſuch like, upon that Surface, and there will be no Neceſſity of watering ſuch Trees afterward, unleſs the Earth be very light. We muſt alſo be careful to apply ſome of the Mixtures of Gums to the Wounds of ſuch great Branches as we may cut off when we come to prune ſuch Trees, and in the lopping of the great Branches, cut them clean to the Stem of the Tree; for if we leave any Stumps, they will make unprofitable Shoots, and rob the other Branches. After this Manner, I have known Elms, Limes, Cheſnuts, Oaks, Ilex, Firrs, Pines, Peaches, Apricocks, Nectarines, Cherries, Plumbs, Vines, Gooſeberries, Currans, and almoſt every Kind of Fruit-Trees, planted with Fruit upon them, which Fruit, for the moſt Part, has ripen'd well, and the little Check, which the Trees receiv'd from this Removal, has brought them into a better State of bearing than they were in before.

In my former Diſcourſe, concerning the Circulation of Sap in Plants, I have given my Reaſon why we ought not to take off the Head of a Tree when we tranſplant it, as the Gardeners do in all great Plantations: And beſides what I have there obſerv'd, I may add, that the Timber will be ſpoil'd by it, for as it is the Stem of the Tree which is to produce the valuable Timber, ſo if we cut off the Top of that Stem, the remaining Part will be ſubject to rot at the Heart, and the Tree, if it grows, will be little better than Pollard. The Gardeners, however, when they plant Wall-Fruit-Trees, always leave their Tops on, 'till they have ſtruck Root, and few of the Trees ſo order'd fail to grow well, therefore it is ſurprizing to find them act ſo contrary to this Practice in planting other Trees, when it is plain that the Principles of Vegetation are the ſame in every Tree.

With the Method directed above for Summer-planting, I have remov'd Peach-Trees, after they have been train'd againſt Walls Six Years, and they have proſper'd very well; and conſidering the Time this Way of planting will gain in making a Fruit-Garden or an Orchard, or a good Shade about an Houſe, ſo as immediately to anſwer their Deſigns; I ſuppoſe that a little extraordinary Expence will not be regarded by thoſe who truly conſider what Time is. In the tranſplanting of Fruit-Trees of this ſtanding, I have found that the conveying them from one Place to another has been the greateſt Difficulty, eſpecially if the Places have been many Miles aſunder. In this Caſe, I have provided large Tubs, ſuch as Pipes cut in Two; in one of which one might well enough put the Roots of Five or Six of theſe Wall-Trees, after having taken all the Clods of Earth from them, and then pour into them as much thin Mud as will cover their Roots, and lay ſome Straw over the Top of it. In the mean Time, the Trees, with their Branches and Fruit, muſt be ſo ſecured as not to fall out of theſe Tubs, nor to be ſtrain'd or torn by the Motion of the Waggon; by this means we may bring them ſafe to their new Station, and then preparing the Holes, or Trenches, as before, take them out of the Tubs for planting One by One, as we want them. In the Carriage of ſmall Plants of Curioſity, I have uſed Bladders fill'd with thin, Mud, prepar'd as before; and have kept Plants in that Manner a Fortnight, without injuring them; or we may convey ſmall Trees ſafely thro' a three Weeks Travel, with laying their Roots in freſh Cow-dung.

But it is neceſſary likewiſe, that we conſider how great Plantations may be made to the beſt Advantage, with the ſmalleſt Expence. It is certain, that there is no better or cheaper Way of raiſing Woods than by ſowing the Maſt or Nutts of Timber-trees, where they are always to remain; but if we come to make Plantations, let us choſe ſmall Plants, of a Yard or Six Foot in free Shoot, rather than large Plants; for in all my Experience, I find the

Plants of Three Foot, will, in Five or Six Years, be taller, and more vigorous, than ſuch Trees as are planted at the ſame Time in the common Way, of Fifteen or Sixteen Foot high.

It is to be obſerved as a general Rule, that in light Soils, if we follow the uſual Seaſons of planting, it is beſt to plant in Autumn, and in heavy Soils in the Spring. What I mean by Autumn is, from the laſt Week of *September* incluſive, to the ſecond Week in *October*; and by the Spring, from the Beginning of *February*, till the laſt Week in that Month; and, whether the Earth be light or heavy, it muſt be ſkreen'd or ſifted in the Holes where we plant the Trees, if we expect our Labours to be crown'd with Succeſs; and immediatly after planting every Tree, give the Ground, where it is planted, ſuch a Watering, as may ſettle the Earth cloſe about its Roots.

I alſo lay it down as a Maxim, that in the planting of Grafted or Budded Trees, we muſt not bury the Tree ſo high as the Bud or Graft, for the Moiſture of the Earth will rot the Foundation of it; and in tranſplanting of Trees, which are neither budded or grafted, we muſt not leſt them be planted deeper than they were before. In the planting of Trees againſt Walls, we muſt take Care, that we do not plant the Bottom of the Stem nearer the Wall than ſix Inches, for, by planting it cloſer to the Wall, the Roots are ſubject to canker, and infect the Branches.

DISCOURSE VIII.

RULES for PRUNING of WALL-TREES, DWARFS, and ſuch others, as are ſubject to the Knife.

AS every Tree was naturally deſigned to remain always in the ſame Station, when its Seed was firſt bury'd, and where it firſt began its Vegetation; ſo in Nature there is no Deſign of Pruning; but ſince by Art, Trees of any Kind may be removed from one place to another, and muſt neceſſarily looſe ſome of their Roots by ſuch Removal, to conſequently Pruning becomes neceſſary, that we may keep a juſt Ballance between the Roots and the Branches; for when a Tree looſes any of its Roots, ſome of the Branches, if not all of them, muſt, on Courſe, be influenced by the Loſs of ſuch Roots, that is, the Stock, upon which ſuch Branches grow, will not be able to receive Nouriſhement enough to Support all the Branches, as it did before it loſt ſome of its Roots; And therefore, when we find ſuch a Tree has began to make new Roots, it is then neceſſary to take as many Branches out of the Head as may be neceſſary to counter-ballance the loſt Roots, that the young Ones, which are now begining to ſhoot, may draw in Supply enough to nouriſh the Buds which are to ſhoot in the Head, for I have obſerved before, that Roots of every Plant, muſt ſhoot before the Buds or Branches, in Order to get Nouriſhment beforehand, to feed the Head of the Plant. In Timber-trees, we muſt always Prune off the Weakeſt Branches, but in Fruit-trees, the contrary is practiſed. However, where Pruning can be avoided, the Tree will fare much better without it; and eſpecially ſince the Uſe of the

Knife is ſo little underſtood, I eſteem it the moſt dangerous Inſtrument that can come into a Garden; for, I am perſwaded, that Three Fourths of the Wall-Fruit in *England*, is loſt every Year by the Knife only; ſo few have we among thoſe who profeſs Gardening, that know any thing of the Matter.

But however, the Knife may be well underſtood by a few, yet there are common Inſtances to prove, that a Tree will proſper better, and bear more Fruit without Pruning than with it; Witneſs all Standard-trees in Orchards, that have been planted very young without Grafting; ſuch as we may frequently meet with in *Devonſhire*. And alſo the Peach-trees, which are rais'd from the Nutt or Stone in *America*, or in *Italy*, and the South of *France*. Thoſe Trees bear plentifully, and are not apt to canker, as theſe are which are ſubject to the Knife. Likewiſe it is obſervable, that Standards either of Pears, or Cherries, or Plums, *&c.* which have been Grafted or Budded, and carefully removed, will proſper well, and bear Plenty of Fruit, without any Pruning at all; ſo in Standard-trees, that have been well managed at firſt, Pruning does not appear to be at all neceſſary.

But let us now enquire into the Reaſon for pruning of Wall-trees: In Order to which, we muſt conſider, that all the Trees, which we plant againſt Walls, are thus ſtation'd, becauſe they are ſuch as are Natives of the warmer Climates, and therefore require the Aſſiſtance of a Wall to defend them againſt the Severity of our Winter Storms, and alſo to receive ſuch a Warmth from the Wall in the Summer, as may expediate the Ripening of their Fruit; for a Wall, heated by a few Hours of the Summer Sun, will remain with a Warmth in it a long time after the Sun has left it, and the Shoots of our Wall'd-trees being nail'd to it, will be advantaged by that Warmth, ſo as to find little Difference between the Warmth of the Wall, and that of its own Climate. Again, the nailing of theſe Trees cloſe to the Wall, ſecures their Shoots, and Branches from being bruiſed by Winds or Hurricanes. Thus we ſee the Occaſion of planting Trees againſt Walls, and the Advantages we receive from it, is, that our

Fruits, againſt our beſt expoſed Walls, will ripen near a Month ſooner than thoſe growing upon Standards: If we ſhould happen to have any Standards of the ſame ſort, ſo that beſides the planting of Fruit-trees againſt Walls, as abſolutely require them, it is thought adviſeable to plant others, in Order to bring them earlier than uſual to the Table. In this Caſe it is neceſſary to conſider firſt, that our Trees have their Branches ſpread in good Order, and that the Branches, which we lay to the Wall, be ſuch as will bring Fruit: Alſo we muſt have Regard to the Number of Branches which we lay to the Wall, that we may leave Room enough for thoſe Shoots which will be made the Summer following; and again, that we allow no Branches to lie a croſs one another, nor ſtrain in any Branch, which happen to ſhoot forward in a Tree; theſe are general Rules: And as to Particulars, we ſhall begin with the Peach, and direct the Manner of Pruning it. In this, we are to obſerve, that the Fruit-bearing Branches are thoſe of the laſt Year, and no others. The ſmalleſt Shoots, which have finiſh'd their Growth the laſt Midſummer, are thoſe which will bear, and the larger Shoots will be unfruitful for this Year; but if we want to fill a Vacancy, they will be of Uſe, by producing Bearing-Shoots for the following Year. Of the ſmall, or Bearing-Shoots, we muſt preſerve thoſe which will beſt come to the Wall, and may prune off their Tops, provided we leave Two or Three Leaf-Buds beyond the Bloſſom-Buds, otherwiſe the Bloſſoms, tho' they may ſet or knit for Fruit, will drop, and diſappoint us. In the leaving of large Shoots, to fill Vacancies, we muſt have Regard to their Strength when we Prune or Top them, *viz.* if they are a Yard long, and as thick as one's little Finger at the Bottom, we may leave them full Two Foot long; conſidering what I have remark'd before, that every Shoot is a Plant growing upon a Tree; and the more the Buds we leave, ſo the Branches they make, will be leſs nouriſh'd, and leſs vigorous, than if we were to leave only a few: and, as I have mention'd above, 'tis the ſmaller Shoots, in this Caſe, will bear Fruit at this Time of pruning, which is the Spring-pruning, and muſt be perform'd when the ſevere Weather is over. We muſt be careful to cut out all the dead or canker'd Wood, and then nail every Branch in its proper Place, rather with

Liſt of Woollen Cloath, than Leather; becauſe Leather, after it has been wet, grows hard, and is apt to bind too cloſe about the tender Shoots, and occaſion them to canker. Again, about Midſummer, when the Summer-Shoot is compleated, we muſt lay up to the Wall, as many of the new Shoots as we can conveniently, in Order to be adjuſted the Spring following. At this Time, we muſt cut off all the ſtragling Shoots, which do not grow naturally, to be lay'd to the Wall; obſerving to cut them cloſe to the Stem, which they ſpring from; and, as it is in Peaches, ſo it is alſo in Nectarines, neceſſary to obſerve the Directions above; for the Manner of their Growing and Bearing is the ſame; nor is the Pruning of the Apricock very different, only the Apricock is more apt to ramp, or ſhoot into great Wood, than the Peach, or Nectarine, and is not to ſubject to canker. When we find our Apricock ſo diſpos'd, we muſt bind down ſome of its larger Shoots Horizontally to the Wall, ſhortening them a little, and the *January* following, we may open the Ground about it, and cut off a great Root or Two, which will prevent its Vigour for the future, and diſpoſe it for Fruitbearing.

bearing. In all theſe Prunings, we muſt ſpread our Branches as Horizontally as we can, by which Means, the Bottom of our Wall will be fill'd, which too generally is left naked and uſeleſs. The Pruning of Plumbs againſt Walls muſt likewiſe be the ſame with the Apricock; for theſe, as well as the Apricock, Peach, and Nectarine, bring their Fruits upon the Shoots of the laſt Summer; but we muſt obſerve, among the great Varieties of Plumbs that ſome will ſhoot more vigorouſly than others, and there will be a conſiderable Difference between the Subſtance of the Bearing-Shoots of one ſort, and thoſe of another: However they will always be known, by being the leaſt Shoots of the Tree they grow upon, and for the others, which are Shoots for Wood, they muſt, if we want them, be top't, in proportion to their Length and Subſtance, as I ſaid before; and it is neceſſary ſometimes to leave one of theſe entire without pruning, to carry off the too great Luxuriance of a Tree. The other Stone-Fruit, which I ſhall have Occaſion to mention, is the Cherry, which alſo brings its Fruit upon the Shoots of the laſt Year, ſo that we muſt be tender how we cut off thoſe Shoots, eſpecially of the *May*-Cherry and the Morello: Some Cherries are apt to bring their Bloſſom-buds in Cluſters, which one may always diſcover at Midſummer, but none of theſe love the Knife. We muſt obſerve in their Pruning, to leave their Summer-ſhoot as perfect as poſſible; for all that is neceſſary to take from them is the *Autumn*-ſhoot, for they do Harm, in expending the Juices of the Tree to no Purpoſe. There is one Remark which we may make upon the Fruits before-mention'd, which is, that the Fruit-buds ſtand cloſer together than the Leaf-Buds; and I have ſaid in another Diſcourſe, are more turgid. But before I leave the Cherry, I am to take Notice, that 'tis the common Practiſe to top the Shoots when we lay them to the Wall; ſo that we may obſerve, there is little Difference in the Management of the ſeveral Sorts of Stone-fruit, which are thoſe chiefly, which are cultivated againſt Walls: the Peaches, Nectarines, and Apricocks, againſt ſuch Walls as are expos'd to the South Sun; the Plumbs and Cherries to the Weſt and Eaſt Aſpects; and alſo to theſe Aſpects ſome of the moſt forward Peaches may be expos'd.

It remains now, that I ſhould preſcribe the Method of Pruning Pears againſt Walls, for ſometimes it is thought neceſſary to give them that Aſſiſtance becauſe ſome Sorts of them will not bring their Fruit to Maturity without ſuch Help, but I cannot joyn with the common Practice of Planting Pears, which are hard to ripen againſt Walls; which are expoſed to a North Aſpect, where they are more out of the Suns way, than if they were in Eſpaliers, or in the open Ground, it is much more rational if they are ſuch as want extraordinary Heat, to Plant them againſt what we call a South Wall; that is, ſuch a Wall as lyes expos'd to the South Sun, here they will have an Oportunity of ripening their Juices: But to be bury'd in Shade will only make their Fruit lager and their Juices harſh: But let us conſider what general Rules may be laid down for the Pruning of Pears; of this Fruit, I muſt remark, as I have done before of the Stone Fruit, that we ſhall find ſome Sorts will always be more Luxuriant than others, or more inclining to Run into great Wood, ſome will make Shoots in a Summer above an Ell long and near an

Inch Diameter, at the Bottom of the Shoot; others will not produce Shoots of half the Strength, and in theſe the ſmaller Branches will ſooneſt bear Fruit; but the others are not to be deſpiſed, for a little time will make them fruitful; that is, that they will produce Fruit Branches without Pruning; as is evident in Standard-trees, it is to be conſider'd principally, in theſe ſorts of Fruit-trees, that ſome Sorts will produce Fruit upon the Shoots of the laſt Summer, even to the very tops of their Branches, other Sorts there are, which bring their Fruit upon the Shoots of two Summers, and ſome which only brings Fruit upon the Shoots of three Summers. This Difference happens from the Juices of one Sort, that are more eaſily digeſted than others, thoſe which are digeſted the ſooneſt bear Fruit the ſooneſt; of theſe Sorts we ought to have, at Pruning-time, as many Shoots as may be convenient to fill the Wall eaſily, ſo as to leave Room for the Product of the Summer, and cut all the reſt away cloſe to the Stem. In thoſe other kinds, which bear upon the ſecond Summer's Wood, we muſt be careful in the ordering our

Branches, ſo as to let our Tree conſiſt of immediate bearing Branches one half, and of ſuch as will come to bearing the following Year another half; ſo we may expect a good Share of Fruit every Year, and in the Pruning of thoſe Trees, which bear upon the Wood of three Summers, let there only appear at one time a third part of the Tree for immediate bearing, one third for the Summer following, and another for the Summer after that, obſerving to take away that Wood which has born Fruit every Year at Pruning-time, which may be any time in the Winter, but beſt in *November.* By this means we ſhall always have our Trees in a bearing ſtate, and they will not lie under the Imputation of being bad Bearers, which is the general Excuſe of bad Pruners. The bearing Buds of all Pears made at *Midſummer*, and they are then very eaſily diſtinguiſhed, becauſe they are three times as large as the Leaf-Buds, and very thick and ſhort, ſomewhat of the Figure of a Boys Top: And upon thoſe, which ſhould remain for another Year, we ſhall find at *Midſummer* two ſmall Leaves at each Joint. Theſe Rules are not only to be obſerved in the Pruning of Pears againſt Walls; but in the ordering of thoſe which are planted in Hedges or Eſpaliers, for they muſt be manag'd the ſame way, except only if we find our Trees unruly or over luxurient, it is proper in Eſpaliers, to let a ſingle Branch in the middle of every Tree grow up without Pruning, and as it riſes above the Eſpalier let it make a ſtem of about two Foot, and then allow it to grow into a Head; from this way of Management the ſuperfluous Juices in the Hedge-part of the Tree will be drawn off, and the Branches in that part will come to bearing much ſooner than they would otherwiſe do; and, at the ſame time, the great Demand of Nouriſhment below will ſo model the upright Branch that it will come to bearing alſo. An Inſtance of this is at *Cambden*-Houſe at *Kenſington*, where I made the Experiment ten Years ago, and I am inform'd by ſome Perſons of Quality, who are my Friends, that the Year, 1724, thoſe Trees where ſo full of good Fruit, that they had not ſeen any thing of the ſame kind equal to them.

It is upon theſe Rules that we ought to Prune all Pear-trees, either againſt Walls or in Eſpaliers, and the Difficulty is only, that in Eſpaliers we muſt keep them in a regular Form, and of a certain Height; but as long as we can lay our Branches horizontally, we are free from the other Inconveniency or Reſtraint. Mr. *John Warner*, a very ingenious Gentleman of *Rotherhith*, or *Redriff*, as it is call'd, has ſomething like this in the Management of his Dwarf-trees, with great Succeſs: When he finds a Tree is inclinable to run into Wood, he leaves the moſt ſturdy Branch, which he can find in the Middle of the Tree, to run up, and carry off the undigeſted Juices; theſe he, very properly, calls the Waſte-pipes. And this Method, with his judicious Rule of Keeping always his Trees full of young Wood, brings him ſo great a Quantity of Fruit, as is admirable; but if we do not follow this Practice in our Dwarfs, or Eſpaliers, (and we cannot well do it on our Walls) and the Trees are yet too luxuriant, cut off ſome of their great Roots in *January*, and it will bring the Trees into a better State of Bearing. We muſt obſerve, that tho' Standard-trees, without pruning, bear more Fruit in Proportion than a Dwarf, or a Tree in Eſpalier, yet the Fruit of the Two laſt, as well as thoſe of the Wall-trees, is generally larger; the Reaſon is, becauſe the Stock has not ſo many Branches to feed in a Tree that is prun'd, as in a Standard; which agrees with what I have ſaid in a former Diſcourſe. 'Tis the Figure of a Dwarf-tree is generally more regarded by the Pruner, than the Fruit it ought to bear, which is the Reaſon it does not always produce Fruit: But take this as a Maxim, that in the Management of Dwarf-Pears, keep your Trees conſtantly in young Wood; and be aſſured, that all Branches, of more than Three Years old, are unprofitable, unleſs they be ſuch as ſuch Shoots ſpring from.

As for the Management of Apples, they are the ſame with that of Pears, but in Eſpaliers and Dwarfs; for I cannot find that our Walls need be troubled with them, and a North-Wall, or a Wall with a North Aſpect, is in my Opinion, fit for nothing but ſuch early Sorts of Fruits as we have a Mind to retard in their ripening.

There are ſtill Vines and Figs, which are to be conſider'd, but the Methods of Pruning them, I ſhall treat of in the following Diſcourſe, relating to Kitchen-Gardens.

DISCOURSE IX.

Of the Diſpoſition of a KITCHEN-GARDEN and the particular Management of VINES and FIGS.

I Have thought it convenient to treat of the Management of Vines and Figs in this Diſcourſe of the Kitchen-Garden, becauſe Vines and Figs ought, by no Means, to accompany Peaches, or Nectarines, or other Wall-Fruit, for they are great Shooters, and the Drip of their Leaves does Miſchief to other

Wall-trees, ſo that where they are planted together, one muſt either be obliged to keep our Vine under by Pruning, and loſe half the Fruit it would produce, or elſe to give it Liberty, and loſe our Peaches.

The Vine is very different, in the Manner of its Growth, from other Wall-Fruits, and ſo its Manner of Pruning is alſo as different. I have, in a former Diſcourſe mention'd the ſeveral Ways of increaſing of Vines, ſo that it will be needleſs to repeat it in this Place: I ſhall proceed, therefore to lay down the proper Rules for Pruning them. We are to know, that all Vines bring their Fruit upon the Shoots of the ſame Summer, and thoſe Bearing-Shoots are always produced from the young Wood of the laſt Summer, *i. e.* the Shoots which will be made in *May*, 1727, will bring their Fruit upon them, and thoſe new Shoots will always ſpring from the Shoots made in the preceding Year, 1726, ſo that old Wood is of no Uſe in a Vine, unleſs it be in the Caſe where we have a Mind to cover a high Wall; In that many Sorts of Vines, which we have in *England*, we find various Manners of ſhooting, ſome will make Shoots of Twelve Foot long in a Summer, and others will not Shoot above Three or Four Foot: We generally find the largeſt Shoots about Three Quarters of an Inch Diameter, towards the Bottom, and the ſmaller Shoots, about the Thickneſs of a large Gooſe-Quill. In the larger Shoots, the Joints, or Internodes between the Buds, are ſometimes 8 or 9, or 10 Inches long; but towards the Bottom of ſuch Branches, the Buds ſtand much cloſer together: Theſe which ſtand the cloſeſt together are fruitful Buds, but ſuch as have long Joints between them, are not fruitful; and in thoſe Trees which are the ſmalleſt Shooters, the Joints between the Buds are ſhorter in Proportion, as well thoſe which are between the unprofitable Buds, as thoſe between the fruitful Buds: But this will be better explain'd by the Figure, as well as the Manner of Pruning, whereby we ſhall find the Neceſſity of leaving the larger Shoots ſometimes above a Yard long, or a Yard and half, when the ſmaller Shoots may not be left above half a Yard. We ſhall alſo find there, how to avoid Confuſion in Pruning, and by One Example be led into the Method of Pruning all ſorts of Vines.

I come next to conſider the Fig, which is a Fruit, in my Eſteem, of good Value, eſpecially ſome of the beſt Sorts, as the Vardone, the *Brugiotti*, and ſome others, which I have got from *Italy*, all of this Sort of Fruit, are apt to ſhoot with great Vigour, and preſently come into great Wood, if we have not a due Regard to prune them; in which Operation we muſt have Regard to cut off ſuch Branches as are neceſſary in warm Weather, for wounding them in Winter, ſpoils the Tree. When the young Shoots of this Tree begins to harden into Wood, we may expect them to knot for Fruit, but as the Fruit grows large, ſo will the Top-Bud of the ſame Shoot ſprout forward very vigorouſly, and if we ſuffer it to grow to any conſiderable Length without nipping off the Top-Bud, our Fruit, however vigorous it may ſeem to be, will be ſubject to drop off before it is ripe. In the ſloping of the young Sprouts, at the Ends of the Bearing-Shoots, we may leave Four or Five Buds upon the green Wood of each of them; and the Conſequence will be, that the Fruit will ripen well, and the green Wood, inſtead of putting out *Autumn*-Fruit, will put out as many Shoots as we left Buds upon the young green Shoots that we prun'd. Theſe laſt Shoots will be ſhort jointed, and bring Fruit the *May* following in great Abundance. We ſhall find the nipping of theſe Buds neceſſary about *June*, and 'till the Middle of *July*, but not later. When we nip off the Tops of theſe Shoots, there will flow a great Quantity of Milk from them, which may make ſome believe the Tree will be injur'd by this Expence of Sap; but there's no Danger, theſe Wounds will heal in a few Minutes, and we ſhall be ſure of Fruit. Some few of the lateſt Sort of Figs may be nail'd againſt South Walls; but, for the moſt Part, Figs will be beſt in Dwarfs or Standards. I have try'd above a Dozen Sorts without Walls, and they ripen very well; and, ſometimes, will ripen Two Crops of Fruit in a Summer. They love a very dry, rocky, or ſtoney Soil, as well as the Vine. We may propagate one Sort upon another, by approching, the Manner of doing which, I have ſet down in a former Diſcourſe.

But I come now to ſpeak of a Kitchen-Garden, and of the Manner of diſpoſing it to the beſt Advantage.

A Kitchen-Garden ought chiefly to be the Place where we cultivate our choiceſt Fruits, as well as Herbs and Roots, for the Uſe of the Table; it ſhould, if poſſible, be Wall'd about for the Sake of the tender Fruits, which we ought to cultivate there as well as for Security. This Garden ought, particularly, to be well expoſed to the riſing Sun, and the South-Sun, to give the Contents of it the greater Perfection, and bring them to a due Maturity. Here we ought alſo to have the Command of Water, and there ſhould be an eaſy Connection between this and the Stable-Yard, for the more eaſy bringing the Dung, or other Manure, and carrying out of Weeds, or other Incumbrances. The beſt Way for ſuch a Garden to be diſpoſed, is to lay it in large ſquare Quarters, and to Fence in ſuch Quarters with Eſpaliers of Fruit-trees, ſuch as Pears, or Vines of the earlyeſt rip Grapes, or Apricocks, or Plumbs; but theſe Fruits ſhould not be mixt in one Walk, but let all the Pears be together, for the Sake of making the Walk all of One Face, and ſo the others in the ſame Manner; the Walks where I propoſe the Hedges or Eſpaliers of Fruit, are thoſe which ſhould be the principal Walks for Pleaſure; and when we have Fruit, to protect them, we ſhall find no Loſs in allowing ſuch a Diſtance between the Hedges, as may prevent one Hedge from over-ſhadowing the other; the Fruit of the Hedges will ſufficiently pay the Loſs of Ground in theſe Walks, and theſe are neceſſary to keep a Correſpondence between one Quarter and another, beſides the Pleaſure of them to Walk in, for a Walk lin'd with Fruit is none of the moſt unpleaſant Sights. Particularly, we ſhould contrive an eaſy Correſpondence between one Part and another of our Garden; for when the Paſſages of Communication are not eaſy, a Gardiner may loſe Half his Time in going from one Place to another about his Buſineſs, which is too much Loſs to the Maſter. For the ſame reaſon we ſhould always contrive our Quarter for Hot-beds near the Stable-Yard, or ſuch Place where the Litter for Hot-beds may be brought in Carts; for if this Spot happens to lie remote from ſuch Places, the Dung muſt be brought a long way in Barrows, to the ſpoiling of the Walks, and the extraordinary Expence of the Mens Time. The Place where theſe Hot-beds ought to be, ſhould be fenced in well with Reeds, and be kept under Lock and Key by the Gardiner, that none ſhould have the Opportunity of looking into his Hot-beds but himſelf; for the lifting up a ſingle Glaſs, for half a Minute or leſs, at an improper Seaſon, will deſtroy his whole tender Crop, and beſides he will then have no Body to blame but himſelf, if any Miſcariage happens. In this Place ſhould be a Frame for Ripening Fruits artificially, if ſuch a thing is deſired, and alſo a Tool-Houſe and a proper Place for drying of Seeds and Herbs, and preſerving of Fruit with Conveniences, if poſſible, for the Gardiner to reſide that he may always be ready to ſurvey his more Curious Works, and be in the way to defend his Treaſure of Fruit from Robbers, which ſhould be conſtantly under his Care, if he be an Underſtanding Man, that every Sort may be brought to Table in its proper Seaſon; and not, as too frequently it happens, to ſend a fine eating Fruit to the Oven, becauſe they are lodg'd in ſuch Hands, where they are not underſtood, and often occaſions either a Reflection to be caſt upon the Nurſery-Man who proved the Trees, or the Gardener's Conduct; for my own Part, I find it the beſt way to have the Name of every Sort of Fruit that is planted in a Garden written at length upon a board, with the Seaſon of its Perfection, and that Board placed over the Tree that every one may ſee it: This Method will ſave the Loſs of a great deal of Fruit in a Garden much frequented, in which Caſe it is too frequently practiſed, to gather harſh unripe Fruit, and after the firſt Taſt to fling it away, and then in the firſt Company decry the Fruit of the whole Garden, tho' perhaps it poſſeſſes the beſt Collection in the World.

As I have mention'd the ſeveral Sorts of Fruits which ought to be train'd againſt Walls, and in Eſpaliers, I come now to obſerve that this is the Garden for Raſpberries, Gooſeberries, Currans and Strawberries; the Raſpberries ſhould be planted in Lines, a Foot a-ſunder, and be free on each Side, the Strawberries in Lines upon Beds, at Ten Inches Diſtance, and be every Spring ſtript of their Runners; or Gooſe-berries and Currans may be planted at Four or Five Foot diſtance, in ſuch Places where there is no conſtant Crop.

There ſhould be, particularly, near the Kitchen, ſome Place planted with all Sorts of Sweet-herbs, as Roſemary, Lavender, Sage, Thyme, Sweet-Marjoram, Penny-Royal, *&c.* for extraordinary Uſe, when the Gardener does not happen to be in the Way.

The other Parts are then to be diſpos'd either for the Leguminous Plants or Pulſe, ſuch as Beans, Peaſe, Kidney-beans, *&c.* or for the Olitary Herbs, as Cabbages, Colly-flowers, Spinach, Aſparagus, Coleworts, *&c.* and for Sallads, Creſſes, Chervil, Taragon, Lettice, Raddiſh, Sellery, Endiff, Corn-Sallad, Fennel, *&c.* and of Roots, Carrots, Parſnips, Beats, Turnips, Scorzonera, Salſifie, Skirrets, Potatoes, Onions, Garlick, Eſchalotts, Rocambole, Chives; And we may add Leeks as an Auxiliary: Theſe make the Sum of a Kitchen-Garden. Now it is to be obſerved, that Peaſe and Beans have a very ſhort Share of Life in the Year, they are Crops of Three Months, and then make Way for others, they are hardy enough, either to be ſown in *November* or *December*, or may be ſown in the Spring. The Beans will proſper in a heavy Soil, but the Pea-kinds rather choſe a light Soil. The larger Sort of Peaſe, ſuch as the *Dutch* Admirals, Rouncevalls, and *Spaniſh* Morettos, muſt have their Lines about Four Foot aſunder, and be ſupported by Stakes, and the ſeveral Kinds of Kidney-Beans, which are given to run or twine, muſt alſo be ſupported with Stakes, but there are ſome Sorts which we call Dwarfs which do not want Supports. Theſe Dwarfs have done their Buſineſs of Bearing in 3 Weeks, or a Month; but the twining Sorts of Kidney-Beans will bear Fruit many Months, and ſome of them, if they could be ſhelter'd from our Weather, would remain fruitful for ſeveral Years. The

Difference that there will be in Beans that grow in light Ground and heavy Ground is, that the light Ground Beans will be ſooner tough and old than the heavy Ground Beans.

For ſowing or planting of Roots, we muſt always lay it down as a Rule, that they will be much ſweeter in light Ground, than in heavy Ground, and be much larger, if they are of thoſe Sorts that run down deep in the Ground, for heavy Ground obſtructs their Growth. The Roots I have mention'd above, ſuch as Carrots, Parſnipes, Turnips, Skirrets, Scorzonera, Salſifie, Onions, and Leeks, muſt be ſown in *February*. Skirrets, alſo, may be propogated by dividing the Roots at that Time: The ſmall Roots of Potatoes may likewiſe be then put into the Ground. Garlick, Eſchallots, and Rocombole, muſt be put into the Ground in *January*, if the Weather be open, and Chives from that Time 'till *May* or *June*. Horſe-Raddiſh, likewiſe, muſt be increaſed from Bits of Roots in ſome of the Winter-Months, when the Leaves are off. The Carrots, Parſnips, Turnips, Beats, and Onions, are Crops of a few Months, but Horſe-radiſh, Skerrets, Rocombole, and Chives, remain in the Ground a long Time; and Potatoes muſt be carefully pickt out of the Ground, to get rid of them: As for Eſchalots, they are to be taken up and dry'd, as ſoon as their Green begins to decay. We muſt Note, that Turnips are alſo to be ſown the End of *July*, for a Winter-Crop; and alſo Carrots may then be ſown, and ſome Onions for the Winter.

As for the Oletary Herbs, ſuch as Cabbages, Colly-flowers, Savoys, Spinach, and Aſparagus, we muſt conſider them in their Order. Cabbages and Colly-flowers may be ſown about the Middle of *July*, in Order to bring forward Plants in Perfection in *May*, but the Colly-flowers Plants muſt be ſhelter'd from the great Froſts of the Winter. We muſt likewiſe ſow theſe in *February*, to have Plants that will be fit for us at the End of the Summer; and alſo in *April*, we may ſow Colliflowers' to have them about *Chriſtmaſs*. All of theſe Cole-Raſe are great Lovers of Water, and are beſt planted for Summer-Crops in moiſt Places. As for Spinach, it is an Herb, which, in the Spring, ſoon runs ſo ſeed, and then has an Earthy Taſte, but we ſow it at that Seaſon, becauſe we have no other boyling Herb but young Cabbage-plants, or Coleworts. In the *Autumn*, we alſo ſow it, becauſe the Winter Weather reſtrains the Juices, and it is not ſo much fill'd with Earthy Parts; it then has its true Taſte, and a Crop of it will laſt the whole Winter, for only the ſingle Leaves of it ſhould be then gather'd, and the Plants will make new ones. In the raiſing of Aſparagus, the Time of ſowing the Seed, is the Beginning of *March*, and when the Plants are one Year old, they will be fit to plant out: For this End, we muſt prepare a freſh Piece of Ground, by Trenching it well, and, according to the Gardener's Rule, bury about Eight Inches under the Surface, a good Quantity of well-conſumed Horſe-Dung. We then mark out this Piece for planting about *February*, and ſet out Plants Ten Inches a-part in Lines, allowing Four Lines for a Bed, and two Foot Space to be made into Alleys, the ſecond Year after Planting; for the firſt Year we let the whole Piece lye ſmooth and even, and ſow Onions upon it: And the Third Year, we ſhall not fail of a good Crop, if our Plants Grow.

For we ſhould not cut any till the third Spring; we muſt obſerve, in the mean time, to mark the Places with Sticks where any of the Aſparagus-Plants happen to be deficient, that we may ſupply the Defects. We muſt alſo take care to provide a rich Piece of Ground for Artichokes, which ſhould be planted from Suckers in *February* or Beginning of *March*, at two Foot Diſtance in Lines, and three Foot ſpace between the Lines; this is a laſting Crop, but will now and than want a little recruiting with freſh Plants in ſome Places, where Plants happen to dye by too much Wet in the Winter, or extream Froſts.

The ſweet Herbs which I have mention'd, ſuch as Thyme, Roſemary, Lavender, Rhue, Sage, Hyſop, Pot-Marjoram, *&c.* they may all be rais'd from Slips or Cuttings, planted in *April* or in *Auguſt*; or we may raiſe Hyſop, Roſemary and Thyme from Seeds ſown in *April*, but by Cuttings is the quickeſt way.

But I am now to ſpeak of Sallads, and the Management.

The Lettice (firſt) is of various Sorts, *viz.* Imperial, *Siletia*, *Roman*, Brown-*Dutch*; all which Cabbage very well; we ſow theſe thinly among our Spring Crops, to Cabbage upon the Spot; and in *Auguſt* and *September* we ſow ſome of the Brown-*Dutch* Lettice, to be planted out for Cabbaging early in the Spring: We have alſo what is call'd the Coſs-Lettice; which, as ſoon as its Leaves are about ten Inches long, we ſhould tie them together with Baſs, in Order to Blanch or Whiten the middle Leaves. Lettice is alſo uſed in Winter, the ſmall Leaves only.

Sellery is another Herb proper for Winter-Sallads, and to be ſtew'd or boyl'd in Soups; this is ſown in *March* and *April*, and when it has made four Leaves, it muſt be planted out upon Beds of fine Earth; and about *July* we may dig Trenches to Plant it in, about ten Inches deep; laying the earth we take out of ſuch Trenches on each ſide, to fling into the Trenches at diſtant times by Degrees, as the Plants ſhoot to blanch them; here the Plants may be ſet 6 Inches aſunder. 'Tis the keeping the Air from Plants which blanches them; and muſt be conſider'd when we have a Mind to blanch any Part.

Radiſhes are alſo neceſſary for Spring-Sallads; we ſhould ſow them among our Spring Crops in *February*, in *March*, and in *April*. And alſo about *Michaelmas*, to come early in the Spring. Remember that all Roots which ſhoot downward, love a light open Soil.

Taragon is another Plant, which ſome uſe in Sallads; but it is very ſtrong, and not agreeable to every Taſt; two or three Leaves is enough for a Sallad: This Plant is propagated by Slips from the Root in *March*.

Charvile is rais'd from Seeds ſown in *March*, and again in *Auguſt* for Winter Uſe.

Creſſes are generally ſown in Lines upon the Natural Ground, from *February* till *November*; and then upon old Hot-Beds under Glaſſes, to cut them in their firſt Leaf; but we may have ſome Creſſes to ſtand abroad in the Winter.

Muſtard and Rape, or Turnep and Radiſh may alſo be ſown in the ſame Manner, and muſt be cut in the firſt Leaf.

Corn-Sallad may be ſown in *March*, and afterwards it will take Care to ſow it ſelf.

Fennel muſt be alſo ſown in *March*, it will laſt ſeveral Years; but dye to the Root every Year. Dill muſt be ſown like Fennel. Sorrel ought alſo to be rais'd from Seeds in *March*; and we ſhould ſow Parſly then, and in *Auguſt*.

As to what concerns the raiſing of Cucumbers, Melons and Muſhrooms, I ſhall ſpeak of that in the Diſcourſe that relates to Hot-Beds and artificial Heats.

DISCOURSE X.

Concerning the Diſpoſition of a FLOWER-GARDEN, with ſome new Obſervations relating to the Improvement of FLOWERS and EXOTIC PLANTS.

BEFORE I enter upon the particular Culture of Flowers, it will be neceſſary to ſay ſomething concerning the Diſpoſition of a Flower-Garden. The Piece of Ground, which we allot for this Uſe, ought to be well ſhelter'd from tempeſtuous Winds, and yet enjoy the Sun; for this end I prefer Hedges of ſuch Trees as loſe their Leaves in Winter, becauſe from the Fall of the Leaf to the Middle of *April*, they are naked, and do not hinder the Sun from influencing the Ground: But as a Flower-Garden is generally a ſmall Piece of Ground, ſo if it was to be fenced with Walls, then would be eddy Winds which would help to blight and deſtroy our Flowers. When I ſpeak of a Flower-Garden, I mean ſuch a Spot as is neceſſary for our choiceſt Flowers, and to try ſuch Experiments in, as relate to their Improvement; this Garden therefore ſhould be fenced from the publick Part of our Garden, that it may be ſafe from indiſcreet Hands, which do not know the Value of a good Flower, nor the Advantage which may ariſe by a good Experiment.

This Piece of Ground ſhould, if poſſible, lie near the Green-houſe, becauſe it may ſerve to ſet our Exotic Plants in, after our principal Show of Flowers is over: And beſides, all our Rarities will be then together, and the Gardener will more readily take care of them, than if our Curioſities were ſtraggling in different Parts of the Garden. This Garden ought to be diſpoſed in Beds, for the Reception of our fine Bulbous-Roots, and our Seedlings of Auriculas, Polyanthos, and the Seedlings of Bulbous-Flowers; the whole ſhould conſiſt of light Soil, even the Allies ſhould be regarded as well as the Beds, for a noiſom Vapour coming from the Allies may under all our Care in the Preperation of our Beds, if we are ſituate upon a Clay, have regard to what I have mention'd in my Diſcourſe concerning Soils, not to dig into it, but lay a good Quantity of light Soil upon it, as well where our Allies are to be, as where we deſign our Borders; what I call a good Quantity is half a Yard thick, if it can be done, and the beſt Part of it skreen'd; when this is done, I think Edgings of Box are preferable to Border-boards, for Box is continually increaſing in Value, while Border-boards are decaying.

The Flower-Garden being thus in Order, we are next to provide Boxes or Caſes of ſeven or eight Inches deep, with Holes at their Bottoms, theſe are for raiſing ſome of the choiceſt Seeds of Flowers: Such as thoſe of Carnations, Auriculas, Renunculas, Anemonies, Polyanthos, Tulips, Hyacinths, Narciſſus, and ſuch like; for from the Seed is produced all the Variety we have of every Race of Flowers. It is a Remark I have made before, that where we have already Varieties of Flowers of the ſame Tribe, ſtanding or growing together, we may expect great Varieties from the Seeds of ſuch Flowers, according to the Doctrine of the Generation of Plants; for the ſowing of the Seeds mention'd before, we muſt provide different Sorts of Earth; for the Auriculas, Polyanthos, Renunculas, and Anenionies, we muſt have rotted Willow-Earth, as we call it; that is, ſuch Earth as we find the Heart of rotted Willows, or, for want of that, the Bottom of an old Wood-Pile well ſifted, will do. But we Uſe this only upon the Surface; for in the Bottoms of the Boxes we uſe freſh Sandy-Loam, if we can get it; the Willow-Earth need not be quite an Inch thick, juſt enough for theſe Seeds to ſtrike their firſt tender Roots in, and none of them muſt be cover'd more than the Thickneſs of half a Crown; the old Method was, to lay the Willow-Earth on very light, and after ſowing the Seed, to preſs the Earth and Seeds down cloſe with a ſmooth Board; and if we ſow them in the Spring, to give them frequent Waterings, and when the Water begins to grow warm, ſet the Boxes in the Shade. It will happen ſometimes, that the Auricula Seed and the Polyanthus Seed, nothithſtanding this Care, will not come up the ſame Seaſon; or, perhaps, but a few of them; but the next *Autumn*, or the Spring following, we may expect a good Crop, as I have obſerved. We may likewiſe ſow theſe Seeds in *September*, which I take to be the beſt Way, becauſe they have the Advantage of a moiſt Seaſon, to bring them up. But we muſt defend them from the moſt rigorous Froſts; as for the Ranunculas, and the Seeds of Anemonies, they are very light, and ſhould be ſown ſhallow in the ſame Sort of Earth in *September*, rather than any other Seaſon; tho' I have known them do well to be ſown in *February*. When we find theſe Seedlings come up, we muſt order them in the following Manner; the Auriculas and Polyanthos muſt be planted out on Beds of fine Earth about Midſummer, and ſhaded for ſome time, as all new planted Flowers or Herbs ought to be; and the Situation they delight in, is where they can Enjoy the Morning-Sun only. The Renunculas and Anemonies which we may rank among the dry Roots, ſhould remain in their

Caſes till they Flower; and then we muſt mark thoſe which are the moſt delightful, and take their Roots out of the Ground as ſoon as the Flowers and Leaves are decay'd: When we have taken theſe Roots up, it is proper to keep the Renunculas Roots in dry Sand; but the Sand muſt be very dry, or the Root will rot; or, according to the common Method, keep them in Paper-bags in a dry Place: The Renunculas and Anemonies will, for the moſt Part, bloſſom the ſame Year they come up, and ſome the ſecond Year, at which time we may expect Flowers from the Auriculas and Polyanthes, and need not ſcruple to remove ſuch as we like beſt into Pots, while they are in Flower.

In the next Place, we muſt provide Caſes for the Seeds of Tulips, Hyacinths, Trittilaries, Narciſſus, Bulbous Iris, Crocus and other curious Bulbs. The Earth for theſe ſhould be very fine and light; and for the time of ſowing the Seeds, it ſhould be as ſoon as they are ripe; remembring the Rule I have laid down before, that all Seeds, in proportion to their Weight and Subſtance, muſt be bury'd deeper or ſhallower in the Earth; the lighteſt and weakeſt of theſe will not bear to be cover'd thicker than the eighth Part of an Inch, and the moſt Subſtantial of them not quite half an Inch. Theſe Seeds will come up the firſt Year, but we muſt have a little patience before they will come to Flower, as four or five Years, it may be; but then we are ſure of new Varieties, and our Labour will be well recompenced. When we have once begun to make ſuch Seminaries, we ſhould ſow of theſe Seeds every Year, to have a Succeſſion of them; and in the mean time we ſhall be be amuſed with our Seedling-Auriculas, Renunculas, Polyanthes, and Anemonies; beſides the Varieties which we may expect from Seedling-Carnations, which I ſhall mention by and by; but in theſe young Nurſeries of Bulbs, we are to obſerve, that the *July* after the Seeds are come up, we ſhould plant them into other Caſes about an Inch and half aſunder, let them ſtand in ſome Place which is well expoſed to the Sun, and where they may be ſhelter'd from ſevere Froſts: The third Year, we may plant them in Beds about four Inches apart; and the Year after that, only take them up for a few

Days, in hot dry Weather, in *July*; and when a freſh Bed is prepared for them, plant the Tulip-roots, Narciſſus, and Bulbous-Iris ſix Inches apart, and the Crocus four Inches; and let them ſtand to Flower. In the ſaving of the Seeds for theſe Seminaris, the Seed muſt be perfectly ripe and dry, when we gather it; and if we ſave it from ſuch Plants as ſtood among a good Collection, we may expect Variety enough from it, according to the Syſtem of the Generation of Plants. *Samuel Trawell*, Eſq; has had prodigious Succeſs in his Undertakings of this Kind, in his Gardens at *Poplar*; eſpecially in raiſing of Tulips and Hyacinths from Seeds: The Tulips particularly are remarkable, becauſe he ſaved the Seed from one Sort of Tulip, call'd, The Triumph of *Europe*, which has a particular Manner of flowering, very different from any others; but as this Flower ſtood among many other curious Tulips, ſo the Seedlings partake of them all, and many of them out-do the very beſt Tulips that have yet appear'd in the World; and his Hyacinths likewiſe are no leſs to be admired.

The Seeds of Carnations or Jully-Flowers ought all to be ſaved from the beſt variagated Flowers, which have ſtood in a good Collection: The Earth to ſow them in, ſhould be fine ſandy Loam, well ſifted, and the time of ſowing ſhould be about the Beginning of *May*; for if we ſow them ſooner they will grow too much into hard Branches, inclining to be woody, and we ſhall hardly get any Layers from them the ſecond Year, when they come to blow. We may ſow theſe upon an open Bed, and plant them out the *Auguſt* following, to ſtand for flowering; the Beds we tranſplant them upon ſhould be narrow, ſo as to hold only two Rows in each; letting the Plants ſtand about a Foot aſunder, for the better Convenience of making Layers of ſuch of them as happen to be worth Increaſing.

The Cyclamens or Sow-beads, are only encreaſed by Seeds ſown in Caſes of fine Earth, as ſoon as the Seeds are ripe.

Having thus ſet forth the Manner of raiſing our moſt curious Flowers from Seeds, I come next to preſcribe the Methods of preſerving and improving them into larger Pots, for blowing, as for thoſe which are commonly called Bulbous-Roots, ſuch as our Tulips, Anemonies, Renunculas, Hyacinths and Bulbous-Iris, they ſhould be taken out of the Ground as ſoon as their Seed is full ripe, and their Stalks and Leaves are decay'd, for ſo long as they are growing, or are green above Ground, ſo long are their Bulbs improving in the Ground, from the Juices which circulate from the Leaves and Stems: But when the Work of Circulation is over in the Leaves, it ceaſes in the Root alſo, and we may take them up; for which Work, we ſhould always chuſe dry Weather, and after ſcaling and picking our Roots clean, lay them upon Mats expoſed to the Sun, for a few Days, without letting any Rain fall upon them, nor ſuffer them to receive any Moiſture from the Dews. When they are throwly dry, put them in Paper-Bags, and lay them in a dry Place till *September*, when we may plant our bearing Roots of Tulips and Bulbous-Iris, and Hyacinths; but it may be the End of the Month before we put the Renunculus and Anemonies into the Ground; at which time alſo we may plant our Crocus, if they happen to be taken up: As for the Anemonies we muſt break their Roots, and chuſe out the largeſt Buds for blowing, and plant the Off-ſets in ſome by Place. The Narciſſus Roots and the Junquil, muſt never remain above a Month out of the Ground; they may be taken up in *June*, and put in again in *July*; for they are very forward to ſhoot. It is a certain Rule, that all Bulbous Roots may be taken out of the Ground, when their Leaves and Flower-ſtalks are wither'd and decay'd, and ſhould be put in again before they begin to ſprout; then our tranſplanting them from one Place to another will be ſafe: For my Part, I know no Neceſſity of taking any Bulbs out of the Ground, but to ſeparate their Off-ſets from them, or when we want to change them, from one Soil to another.

As for the Polyanthos, and Auriculas, they delight in the ſame Manner of Treatment; that is, the Soil for them ſhould be light ſandy Loam, and when we plant them in Borders under Walls, thoſe Borders ſhould lie ſteep and ſlopeing, to fling off the Wet, but we muſt always chuſe out ſhady Places for them. The time of encreaſing theſe, by taking off their Off-ſets, is when they have almoſt done flowering, or at St. *James*-tide; which Work ſhould be done every other Year, at furtheſt: The Polyanthos will proſper much better in Beds than it Pots, but our fine Auriculas muſt be potted, that we may ſhelter them when they are in Flower; for their Beauty is loſt if we ſuffer their Flowers to take the Rain, which daſhes off the fine Duſt which give them their rich Appearance.

The Carnation or July-Flower, ought alſo to cultivate in Pots, when we blow them in a Collection: The time of laying them for Encreaſe is as ſoon as the Layers or Shoots, growing about the Roots, are long enough; that is, when they have five or ſix Knots or Joints between their Roots and the Crown or Tuft of Leaves. We then clear away the Leaves from the Joints, and with a fine Penknife cutting one of the Joints half through, we then turn our Knife and ſlit it upwards towards

the

the other Joint; and ſo pin it down into the Earth, with a little Hook of Wood. Sometimes we may do this Work in *June*, and ſometimes not till *July*, 'tis as the Layers are fit for it: When theſe have taken Root, which will be in ſix or ſeven Weeks time, if we keep them water'd, take off the Layers, and plant them in ſmall Pots about four Inches over, in which we may let them remain till the Middle of *February* following; and then turning them out, with the Earth about them, we muſt plant them, but we muſt take care to ſhelter them in ſevere Weather, in ſuch a Place where they may have Air enough. As ſoon as theſe Plants begin to ſpindle for flowering, we muſt ſet Sticks by every one of them, in order to ſecure the Spindles from breaking by the Winds; we tie theſe gently to the Sticks, with Baſs, and when their Buds appear, we take away all but two or three, that the Bloſſoms may be ſtrong; one Bloſſom upon a Stalk is enough, if we would have them large.

Having now lay'd down proper Rules for the Management of our choiceſt Flowers, I ſhall proceed to give Directions for the ordering of thoſe Flowers, which are call'd *Vivaceous*; what I mean by vivaceous Flowers, are ſuch, whoſe Roots are conſtantly laſting and increaſing in the Earth, and which put forth Flower-ſtems every Spring, which decay as ſoon as they have done Flowering; of theſe are the Peony, the Aſters or Stanwort, and many others: The time of increaſing them is, while they are vacant of their Flower-ſtems, and we may part their Roots ſafely. This is a general Rule which ſerves for all Flowers of this Nature.

The fibrous-rooted Flowers, which are conſtant above Ground; ſuch as the Violet, *&c.* the beſt Time of tranſplanting or increaſing them, is juſt before they make their Spring-Shoot, or about *September*.

The Stock-Gilly-Flowers, Wall-Flowers, and ſuch like, which will endure two or three

Years only, muſt be rais'd from Seeds ſown in *March*; and we may alſo raiſe them by Cuttings in *Auguſt*, or the Spring.

It remains now that I ſpeak of Annal-Flowers, which may be ſown upon the natural Ground; for the more tenderer Sorts, I have treated of them in the Diſcourſe of Hot-beds and artificial Heats. Thoſe which I ſhall mention here are the Lark-ſpurs, Corn-bottles, Lobels, Calch-fly, *Flos Adonis*, Poppies, Annal-Stocks, Candy-Tufts, Venus-Looking-Glaſs, Venus-Navel-Wort, Lupines, Scarlet-Beans, Wing'd Peaſe, Sweet-ſcented Peaſe, and ſuch like; we may ſow them all, but the four laſt, in *March*; and the other four will do better to be ſown in *April*. We muſt be ſure to Water evrey thing we tranſplant; very well, for a good Watering at that Time, ſave a great many Waterings. And the beſt Time of the Day to tranſplant in Summer, is in the Afternoon; a little before the Sun is going down; for the Dews of the Night help the Plants. It is alſo neceſſary, if it can be done conveniently, to ſhade all Plants for three or four Days, after tranſplanting.

I now come to ſpeak of Exotic-Plants: We muſt firſt conſider every Exotic or Foreign Plant, is maintain'd by the ſame Principles of Vegetation, as the Plants of our own Country: We muſt underſtand likewiſe, that all ſuch Plants as are brought to us from Abroad, do not require Shelter in the Winter; we muſt learn the Countries they came from, and conſider the Climates, in Order to give them ſuch a Share of Heat or Cold with us, as they enjoy'd when they were at Home. We ſhould alſo inform our ſelves of the Times when their Spring happens in every Country we receive Plants from. All which we eaſily learn from the Name of the Country; for that being given, we have the Latitude in Courſe from the Mapps, and then by finding out the Courſe of the Sun, we know when that Country is the moſt influenced by the Sun, and may judge in what Degree ſuch a Country is heated by it. For the better Information of the Gardeners in theſe Particulars, I have publiſh'd a Table of Latitudes and Degrees of Heat, in my Monthly Works; and have regulated Thermometers accordingly, to act with the more certainty, when we apply any of our artificial Heats to Plants; which Mr. *John Fowler*, an excellent Mathematical Inſtrument-Maker, in *Swithin*'s-Ally by the *Royal-Exchange*, has ſo contrived, that all of his making are exact in their Motions one to another; or, as one may ſay, work together in true Proportions; ſo that thoſe in Hot-Beds, Stoves, Green-houſes, or other Places, bear a juſt Proportion to one another, with regard to their different Degrees of Heat or Cold. It is neceſſary however to know, that fifteen Degrees higher than his Degree of Heat, mark'd for the Ananas or Pine-Apple, is ſufficient to ſupport Plants which are brought to us from under the Line, or ten Degrees Latitude on either Side of it. And I think it is impoſſible to come nearer a certainty, than by this Method; becauſe we may always manage our Fires ſo, as to keep the Air in the Houſe, within few Degrees more or leſs of the Point we aim at, as will appear by the Spirits in the Thermometer. As for Plants which come from Places between ten Degrees, and two or three and twenty Degrees

Latitude, we muſt keep the Air of our Conſervatory ſo warm, as that the Spirits in the Thermometer may riſe to the Height where the Word Ananas is placed. The Plants which are brought from thoſe Parts of the World, as lie between the Latitudes of twenty three and thirty ſix, will require another Houſe, where the Heats need not be ſo great as the former; and then a common Green-Houſe, which will only keep out Froſts, will be ſufficient to preſerve ſuch Plants in the Winter, as are Natives of Countries lying between thirty ſix and forty eight Degrees Latitude; and for all other Plants, growing in Latitudes from forty eight to the moſt Northern Latitude, they will do beſt abroad in our Climate; we ſhould by no means give them Shelter in an Houſe, nor attempt to give them any artificial Warmth upon any account; for Warmth is quite contrary to the Nature of ſuch Plants, as are Natives of the frozen Climates; which I think neceſſary to hint at, becauſe I have known ſome ingenious Gardiners, who by applying artificial Heats to Plants brought from *Hudſon*'s *Bay*, have deſtroy'd them.

With all the Plants which we receive from Abroad, we ought to have an Account of the Soil and Situation where they grew; for it is remarkable, that there will be as much Difference between the Temper of the Air on the South Side of a Mountain and on the North Side, as one ſhall find in ſix or ſeven Degrees of Latitude upon a Plane. And again, we may remark that all Trees of the Firr-kind, or others of the like Sorts, which abound in Terebintine Juices, will bear to ſtand abroad with us, tho' we find them naturally growing between the Tropies; and as for the Soil, it is as neceſſary to be known, becauſe we find that ſome Plants are natural to Boggs, others to Rocks and ſtony Ground, and ſome which are Inhabitants of the Waters only; ſo that if we were to attempt the Culture of ſuch Plants in a contrary Manner from their natural Mode of Growth, we ſhould certainly deſtroy them.

Upon the Foot of theſe general Remarks, the Culture of Exotic-Plants may be render'd eaſy and familiar, and without conſidering them, our Labour muſt always be uncertain.

In Order ſtill to help us in our Deſigns, with regard to the Culture of the moſt tender Exotic-Plants, it will be neceſſary that I lay down a few proper Rules to be obſerved in Building of Stoves and Green-Houſes. In all Edifices of this Nature, our firſt Conſideration ought to be the Situation; ſo that the Front of our Building may receive the Benefit of the Sun, as much as poſſible in Winter; it is therefore we chuſe to lay our Front expoſed to the South, or South-Eaſt; which laſt I think much the beſt, becauſe our Houſe then receives the Morning-Sun, which is of great Moment after the long Nights. In the Fronts of theſe Conſervatories we cannot have too much Glaſs, and, if poſſible, the whole Front ſhould be Glaſs, if the Roof of the Houſe could be ſupported. On the other hand the Back-Walls of ſuch Conſervatories cannot well be too thick, to keep the Cold Northern-Air from penetrating into the Houſe; and for the Eaſt and Weſt ends, if our Houſe fronts the South, it is neceſſary to have a large Pannel of Glaſs in each of them; for in the Winter, when our tender Plants want the Sun the moſt, and the Weather is moſt commonly gloomy, then half an Hour's Sun is of extraordinary Benefit to Plants, in correcting the Damps of our Houſes, and no Opportunity ſhould be loſt of receiving the Sun at any time of the Day, when it has any power; for every Minute of the Sun's Preſence rarifies the Air in our Houſes, and puts it into a quicker Motion than it was before, till in a quarter of an Hour our Houſes will be warm, and will continue nearly of the ſame Warmth till ſixteen or eighteen Hours afterwards, if we do not prevent it by letting in the cold Air upon it, when the Sun is gone off: The Obſervation I make concerning the Air's remaining warm ſo long as ſixteen Hours, if we do not open the Doors, is done by obſerving the Height of the Spirits in the Thermometer, which one may perceive eaſily thro' the Windows.

But notwithſtanding how neceſſary it is, when we have only a ſhort Gleme of Sunſhine, to let our Houſe remain cloſe till the Morning following, yet it is as neceſſary to refreſh our Houſes ſometimes with Air from abroad, which ought to be as frequent as poſſible, always having regard to the Climate our Plants come from; and to judge, in ſome Sort, what Degree of Cold they will bear without Injury; I have therefore thought it neceſſary in all Conſervatories, which I have built for the Preſervation of tender Plants, to make the Entrances into them from ſome Room, rather than to let in the open Air at once upon the Plants; by which Practice, I found that my Plants proſper'd, and flouriſhed better than others, where this Conveniency was wanting.

The Floors of theſe Conſervatories ſhould rather be laid with ſquare Tiles than with any Hard Stone; becauſe ſuch Stone, as it is very hard, is apt to condenſe the Air of the Houſe, and have a Dew lie upon them in moiſt Weather, which is no way healthful to Plants; but the Tiles I ſpeak of, are ſo ſpongey that they imbibe the Moiſture of the Air of the Houſe, and prevent thoſe pernicious Damps, which occaſion Mouldineſs upon Plants, which is very frequent in ſuch Conſervatories as are pav'd with hard Stone or Marble. Nor is a Floor of Boards proper in ſuch a Place, becauſe by frequent watering our Plants, a boarded Floor will ſoon rot. Again, we muſt obſerve in building our Conſervatories for the moſt tender Plants, I mean ſuch as are Natives of Places near the Line, or Ten, or Fifteen Degrees Latitude on either Side the Line; ſuch Conſervatories ſhould be very ſhallow, that is, between the South-Front, and the Back, not above Seven or Eight Foot, provided that the Glaſſes in the Front are as high; and ſo in Proportion to the Height of the Glaſſes in the Front, we may make our Stoves deeper or wider. Some are of Opinion, that the Front Glaſſes of ſuch Houſes ſhould lie ſloping, ſo as to drop about a Foot from the upright; but I do not ſee any great Occaſion for that Situation of the Glaſſes, if our Front is all Glaſs, there are good Examples of this Kind at *Chelſea* Phyſick-Garden. We ſhall alſo find it neceſſary in ſuch Structures to raiſe the Floor about Two Foot above Ground, becauſe under ſuch Floors muſt lie our Pipes of Conveyance for Heat, of what are generaly call'd Flues, which never ſhould be bury'd in the Ground, for the Moiſture of the Earth damps the Fires. Theſe Flues ſhould run from the Fire-place along the Front of the Conſervatories, and turn at the End with a Sweep, and then along the Back of the Houſe, and up a Chimney. The Fire-place ſhould be large, like an Oven, and covered with an Iron-plate; which Plate, being once heated, will keep the Air of the Houſe dry and warm, a long time, with a ſmall Fire of Turfs or Peats, or ſuch Cakes as are made by the Tanners of their old Bark. And it muſt be obſerved, that when we begin to make Fires in theſe Stoves, we muſt continually keep them on Foot, till the Seaſon is warm enough to leave them off, which our Thermometer will inform us, as well as inſtruct us when our Stove is too hot, which is as great a Fault as being too cold: If our Houſe ſhould happen to be over-hot, the Air will conſequently be too dry, and the Plants will ſuffer by wanting the Nouriſhment which they draw from a free, warm Air; but we may remedy this, letting in freſh Air from the Room adjoining, thro' Pipes which one may place in the Wall for that purpoſe. It would be well likewiſe to take care, that our Roof be well lined with Straw, to prevent the Cold on that Side; and I think that good Shutters to the Windows in the Front, would be neceſſary in ſevere Weather, tho' ſome uſe Mats only to cover their Glaſſes when the Weather is extream Cold. Theſe are the neceſſary Precautions to be taken in building our Hot-Houſes; only to render them uſeful in Summer as well as Winter, we may have a Trench in the Floor, about four Foot wide, and within four or five Foot as long as the Stove, and about two Foot and half, or three Foot deep, to be brick'd on all Sides: The Uſe of this Trench is for Tanners-Bark in the Summer-time, into which we muſt then plunge the Pots with our Ananas or Pine-Apples, and ſuch other Plants as come from the hotteſt Countries.

But over Stove Fir-Plants, which require a leſs Share of Heat, we may allow it to be ten Foot wide, and uſe our Fire-Flues with Gentleneſs, allowing more Air in this than the

Plants in the former will bear; and our Green-Houſe, if the Front to the Cieling is 16 or 18 Foot high, then we may ſuffer it to be 16 or 18 Foot wide, and our Windows ſhould be the ſame Heighth; obſerving alſo, that the Peers of Brick-work between the Glaſs, be as narrow as can be, for the ſafety of the Roof; for if the Peers be thick, then we ſhall never have the Sun full in the Houſe, but at Noon; which is the Caſe of many large, pompous Green-Houſes, which have been built within the laſt twenty Years.

'Tis to be obſerved, that a large Green-Houſe will keep the leaſt tender Plants, ſuch as Orange-trees, and ſuch like, much better than a ſmall one; becauſe the Quantity of Air which is contain'd in a large Space, will be longer nouriſhing to Plants, than what can be encloſed in a ſmall Houſe; ſometimes the Severity of the Weather will occaſion the Gardiner to encloſe his Green-Houſe for a Month or more, without giving any Air at all; and then upon admitting freſh Air, on ſudden it will have as bad an Effect upon the Plants, as if we were to let Plants want Water too long, and then give them a Flood to make good the Deficiency; this would make them ſhed their Leaves, and make them diſtemper'd; but in a large Houſe, the Air encloſed for three Weeks or a Month, will remain ſtill nouriſhing to Plants; and the Admiſſion of freſh Air upon ſuch a Body of encloſed Air, will not ſo readily hurt the Plants, as when it is to be let in upon a ſmall Body of encloſ'd Air. The late Lord *Capell* had no Regard to Glaſs in the Front of his Green-houſe, for Orange-trees, Myrtles, and ſuch like, and in the place of it, put Canvas Saſhes and Shutters to them; for he well knew how neceſſary Air was to Plants of their Nature, and as well knew the Ignorance of the Gardiners of his Time, in judging of the proper Seaſons to give Air to confine Plants; and therefore provided againſt it by this Means, and againſt Froſt by the Shutters.

Our Pots and Caſes for Exotic-Plants ought to have the Holes at the Bottoms clear, that at the ſeveral Waterings which we give to the Plants, the Water may paſs eaſily thro'; for if there is not a free Paſſage, the Water will chill and rot the Roots; as I have related in a former Diſcourſe, where I have alſo taken Notice of the Quantities of Water which ſhould be diſpenced to different kinds of Plants, in that Maxim, that the moſt ſucculent Plants require the leaſt Share of it. And it is neceſſary to obſerve likewiſe, that the very ſucculent Plants of all, ſhould have no Water from the End of *September* to the Middle of *March*, if we do not keep them in our hotteſt Houſes, where the Air is kept dry all the Winter; for the common Moiſture of the Winter Air in Green-Houſes is ſufficient to feed them.

As for the Earth for Orange-trees and others, which are to undergo the Fatigue of the Houſe, it ought always to be indifferently light, for the better Paſſage of the Water through the Pots; but it ſhould be tenacious enough to hold ſome Share of Moiſture; and for the moſt ſucculent Plants, it muſt be of a dry Nature, as I have related in a former Diſcourſe. For the Seaſons of ſetting our Plants out of the Conſervatories, there is one general Rule, depending upon the Latitudes which they come from on this Side the Line, thoſe of the moſt Northern Latitudes, which muſt be houſed, may be ſet abroad firſt, and ſet the laſt into the Houſe; but it is dangerous to let any be put abroad till the violent Froſts are over, and to leave them abroad till ſmart Froſts begin; for Myrtles, and ſuch Sorts, *April* is commonly the Seaſon of ſetting them out, and *October* of putting them into the Houſe; but Orange-trees, and the Plants that accompany them, is better about the Middle of *May*, and Middle of *September* to ſet them out and in; obſerving, if poſſible, to ſet them Out in wet, and into the Houſe in dry Weather.

Some others of the tendereſt Sorts, which may come abroad in Summer, muſt ſtay till the Beginning of *June*, before they are put out, and be return'd in *Auguſt* : But in the ſetting out thoſe Plants which ſhould be the moſt early abroad, we muſt have Regard that they are not in their tender Shoot, becauſe a little Froſt will hurt them. Upon theſe Foundations we may cultivate any kind of Exotic-Plants.

BRITISH MUSEUM

FINIS.

MUSICK *Engrav'd and Printed for* J. CLUER *and* B. CREAKE. *And Sold by* A. CAMPBELL *at the Printing-Office in* Weſtminſter.

A Pocket Companion for Gentlemen and Ladies: Being a Collection of the fineſt Opera Songs and favourite Airs out of the moſt celebrated Operas, compos'd by Mr. *Handel*, *Bononcini*, *Attilio*, &c. in *Engliſh* and *Italian*: To which is added, ſeveral choice Songs of Mr. *Handel's*, never before printed (in two Volumes) carefully corrected and figur'd for the Harpſicord, alſo tranſpos'd for the Flute in the moſt proper Keys. *Price* 1 *l.* 5 *s.*

Medulla Muſica: Being a Collection of Airs, *viz.* Allamands, Sarabands, Gavots, Jiggs, Minuets, and other valuable Pieces, extracted from the Works of the moſt celebrated Maſters, *viz.*

Corelli,
Bomporti,
Torelli,
Tibaldi,
Albinoni,
Bononcini,
Pepuſch,
St. Helene, &c.

In two Volumes, Treble and Baſs, the Baſs figur'd for the Harpſicord. A Work of this kind never before attempted in two Volumes, 12 *s.* 6 *d.*

The Monthly *Apollos* for *July*, *Auguſt* and *September*, 2 *s.* 6 *d.*

Julius Cæſar for the Flute. 2 *s.* 6 *d.*

Tamerlane, Ditto 2 *s.* 6 *d.*

Diamonds cut Diamonds, or the Muſes *Apollo* for the Year 1726. Being a Choice Collection of fifty two merry new Songs; the Words and Muſick by Mr. *Carey*. 1 *s.* 6 *d.*

The firſt and ſecond Pack of muſical Playing Cards; on each Card there is a particular Song, ſet to Muſick, which is alſo tranſpos'd for the Flute; each Pack 3 *s.* 6 *d.*

The Tonometer, explaining and demonſtrating, by an eaſy Method in Number and Proportion, all the thirty two different Notes, Adjuncts, or Suppliments contain'd in each of four Octaves or common Scale of Muſick, with their exact Difference and Diſtance, whereby the Practitioner, on any key'd or fretted Inſtrument, may eaſily know how to tune the ſame, and alſo, with great Exactneſs, how to tranſpoſe any Muſick from any one Key to another, ſharp or flat, higher or lower, with proper Sharps or Flats thereto, never before publiſh'd: By *Ambroſe Warren*, *Lover of Muſick*. 2 *s.* 6 *d*.

A Choice Collection of Pſalm Tunes, Hymns and Anthems, for the Delight and Improvement of all who are truly Lovers of divine Muſick. By *William Anchors*. 3 *s.* 6 *d.*

The Pſalm-Singer's Guide, or an Inſtruction to Pſalmody, by plain, eaſy and familiar Rules, that any Perſon almoſt whatſoever, tho' of the meaneſt Capacity, may be directed how to ſing the moſt difficult Pſalm by Book, containing in the whole near ſixty of the choiceſt and neweſt Pſalm Tunes for two Voices, namely Treble and Baſs; to which is added, a Scale of the ſeven Keys of Muſick, ſhewing how to tranſpoſe any Tune from one Key to another, and likewiſe how to ſing or *Sol-fa* right in any of the Keys whatſoever. By *Matthew Debnam*, Singing-Maſter. 1 *s.* 6 *d.*

The following whole Operas in Score, compos'd and figur'd by Mr. *Handel*:

Julius Cæſar. 15 *s.*
Tamerlane. 16. *s*
Rodelinda. 18 *s.*
Scipio. 18 *s.*
Alexander, 1 *l.* 1 *s.*

BOOKS *printed for* B. CREAKE *at the* Bible *in* Jermyn-ſtreet, *over againſt* St. James's *Church.*

The Second Edition of

DR. *Keating*'s General Hiſtory of *Ireland*: Containing an Account of the firſt Inhabitants of that Kingdom; with the Lives of 170 ſucceeding Monarchs: The Original of the *Gadelians*, and their Travels: The Aſſiſtance the *Iriſh* afforded the *Scots* againſt the *Romans* and *Britons*: A Deſcription of the Courage and Liberality of the ancient *Iriſh*; their Laws to preſerve their Records and Antiquities; alſo an Account of their Royal Aſſemblies at *Tara*: A Relation of their Wars with the *Danes*; and the Arrival of *Henry* II. King of *England*. To which is added an Appendix, collected from the Remarks of the Learned Dr. *Anthony Raymond* of *Trim*, not in the former Edition. Illuſtrated ſtated with above 160 Coats of Arms, and 42 Copper-Plates. *Price* 1 *l.* 10 *s.*

The famous Trial of *John Hampden*, Eſq; in the great Caſe of Ship-Money, with King *Charles* I. in which is the ſeveral Arguments of Council on both ſides; with the Opinion of all the Judges on the Bench in the Exchequer-Chamber: Alſo Mr. *St. John*'s Speech in the Houſe of Lords, and Mr. *Waller*'s in the Houſe of Commons; likewiſe his Speech at a Conference of both Houſes in the Painted-Chamber. To which is added the Trial of *Thomas Harriſon*, with the Proceedings thereupon, and his Sentence by the Court. 11 *s.*

Lectures of experimental Philoſophy, wherein the Principles of Hydroſtaticks and Opticks are demonſtrated at large, by a great Number of curious Experiments. A Deſcription of the Air-Pump, and the ſeveral Experiments thereon; the Condenſing Engine; the different Species of Barometers, Thermometers and Hygrometers. With ſeveral Experiments to prove and explain Sir *Iſaac Newton*'s Theory of Light and Colours, as perform'd in a Courſe of Mechanical and Experimental Philoſophy. By *J. T. Deſaguliers*, M. A. and F. R. S. Illuſtrated with ſeveral Copper-Plates ſuitable to each Subject: To which is added, a Deſcription of the Machine call'd the Orrery. 5 *s.*

A Method of ſtudying Phyſick, containing what a Phyſician ought to know, in relation to the Nature of Bodies, Laws of Motion, Staticks, Hydroſtaticks, Hydraulicks, and the Properties of Fluids, Chymiſtry, Pharmacy and Botany, Oſteology, Myology, Splanchnology, Anology and Diſſection; the Theory and Practice of Phyſick; Phyſiology, Pathology, Surgery, &c. The whole *Praxis Medica Interna*;

with the Names and Characters of the moſt excellent Authors on theſe ſeveral Subjects in every Age. Syſtematicks, Obſervators, &c. their beſt Editions, and Method of reading them. 5 *s.*

De viribus Medicamentorum: Or, A Treatiſe of the Virtues and Energy of Medicines, containing an ample Account of all Medicines whatſoever, whether Phyſical or Chirurgical, Internal or External, with their ſeveral Qualities and proper Doſes; as alſo Mathematical Obſerſervations on the Nature of Solids and Fluids, with reſpect to human Bodies: With an accurate Account of the Properties of the Blood, of its Conſiſtency and Laws of Motion: The whole being interſpers'd with many curious Remarks, never before publiſh'd; (theſe two laſt) by *Herman Boerhaave,* now Profeſſor of Phyſick in the Univerſity of *Leyden.* 5 *s.*

Medicina Brevis, or a ſhort Account of the primary Cauſes of moſt Diſeaſes. With a ſuccinct Account of the original Cauſe of Plagues and peſtilential Diſtempers, and the beſt Experimental Remedies for their Cure. By *John Hanſell, Chymic. & Pharm.* 2 *s.* 6 *d.*

Sepulchrorum Inſcriptiones: Being a curious Collection of the moſt remarkable Epitaphs in the Kingdoms of *Great Britain, Ireland, &c.* in *Engliſh* Verſe, being the firſt Number of the Second Volume. To be continu'd every two Months. 1 *s.* 6 *d.*

Variety: A Poem, humbly offer'd to the God of Change. To which is annex'd an Anſwer to an *Ovid*'s Epiſtle. Dedicated to the Earl of *Seafort.* 1 *s.* 6 *d.*

LXXXIIII–7

To Sir Jos: Banks
with the Author's most
respectful Compliments